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Kesmas

Jurnal Kesehatan Masyarakat Nasional
(National Public Health Journal)

Quarterly Journal

Special Issue:

Lesson Learned from the COVID-19 Pandemic in Climate Change and Health Policy

Nationally accredited and indexed in SINTA-S1 by Ministry of Education and Culture of the Republic of Indonesia & SCOPUS coverage years from 2016 - present

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Dear Editorial Team, Authors, Viewers, Subscribers, and Readers

For the fourth edition of Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal) Special Issue, the World Health Organization has announced that COVID-19 is now an ongoing health issue and no longer a public health emergency of international concern (PHEIC). I hope the articles curated in this Special Issue will discuss more about this matter. Also, a reminder for us to keep maintaining the health protocol even though the PHEIC status has been revoked. These three years have been challenging for us all. Hopefully, there will be lessons learned from the COVID-19 pandemic. **(Rania, Solo)**

INFORMATION

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    - Book :
      Grech ED. ABC of interventional cardiology. 2nd ed. Chichester: Wiley blackwell; 2011. Available from: https://ebookcentral.proquest.com/lib/imperial/detail.action?docID=822522
    - Online article :
      Pullen LC. Antibiotic resistance continues to be a problem in children. Medscape; 2017. Available from: https://www.medscape.com/viewarticle/860801
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Asyary. *Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*. 2023; 18 (Special Issue 1): 1-3
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Editorial

Dear Colleagues,

Welcome to the fourth Special Issue!

I would like to join in joy with all of you for my appointment as the new Editor-in-chief of Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal). Our gratitude to the previous Editorial Board of Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal), led by Prof. Dr. Dewi Susanna. As her name, Dewi, means "Goddess," Prof. Dewi Susanna always brings her agility, positive thinking, as well as compassion and leads by example in developing the journal in brilliant ways all this time. Our special appreciation tributes also to Assoc. Prof. Dr. Tris Eryando, the former co-Editor-in-chief, showed his precious contribution, guidance, and trust not only to the development and success of this journal, but also to its regeneration. Both your excellent services will always be remembered. Thank you, Professors!

While World Health Organization (WHO) has declared that coronavirus disease 2019 (COVID-19) was over as public health emergency of international concern (PHEIC) by 5 May 2023, some countries, including Indonesia, had previously recognized that it is no longer a threat by stopping the pandemic measurement regulation. This situation may lead to a perception of the big question: what's next? At least, there are two opinions, including how to recover with a stronger health system (reform) and how to anticipate the next environmental and public health threat in the future. This special issue provides peer-review articles in the form of original research, (systematic) review, and case reports articles that discuss these topics related to environmental and public health preparedness in the post-COVID-19 pandemic era.

In terms of post-COVID-19 pandemic reports, "recover stronger" became an eager point from previous COVID-19 evidence. However, how is it going on? Some reports are discovered in this special issue. Novarisa, *et al.*, observed the case series of the five weeks following the WHO's revocation of PHEIC status (6 May–10 June 2023), especially in the Indonesia chapter. Although it seems that Indonesia's daily cases showed a decreasing trend, COVID-19 patients still require intensive care, and survivors often experience post-infection effects. This situation presents further challenges for the Indonesian Government as it prepares for the transition to COVID-19 becoming endemic. Nazir, *et al.*, identified that both clinical and functional outcomes could appear to COVID-19 survivors in long-term ways. These clinical outcomes include the appearance or persistence of general symptoms, multi-organ symptoms, decreased lung function, and nutritional disorders. In contrast, the FO includes decreased muscle strength and physical performance, psychological or cognitive disorders, increased disability or dependency, as well as decreased vocational status and health-related quality of life. Thus, this study suggests good cooperation between medical personnel and survivors is needed to improve the health-related quality of life and prevent persistent anatomical and physiological damage to the body. Hanum, *et al.*, concluded that oral hygiene is related to the emergence of oral manifestation in COVID-19-infected patients. In facing future challenges, it is considered that dental professionals give dental education on how to improve oral hygiene adequately. Halifu, *et al.*, extracted the final 21 pieces of evidence of the COVID-19 pandemic on adolescents' physical growth and personal hygiene. The pandemic has induced adolescents to consume unhealthy and high-sugar foods frequently. At the same time, these age groups tend to embrace new knowledge when it is presented engagingly and aligns with their preferences, including on these issues of personal hygiene. This review may reference strengthening health promotion and behavioral exposure toward quality of life improvement during emergencies can happen anytime. Kurniati, *et al.*, presented that people may have a psychological impact though they have valid information due to the infodemic since they searched for information from relevant and credible sources (government and researchers). Therefore, developing health messages and choosing the proper channels to facilitate sustainable preventive behaviors should be taken into account in the community post-pandemic situation. Wijaya, *et al.*, found that pulmonary rehabilitation programs for COVID-19 survivors with severe and critical cases have improved respiratory functions. This program includes breathing, strength, stretching, cardiorespiratory endurance exercises, respiratory physiotherapy, relaxation techniques, and education. Saki, *et al.*, concluded that environmental conditions with high humidity and rainfall can reduce COVID-19 cases. Considering the study's limitation on the ecological ap-

proach, nevertheless, society can take lessons from this study to always be vigilant and continue to implement health protocols amid the role of climate that can affect more diseases, including re- and/or new-emerging diseases such as COVID-19. Azizan, *et al.*, produced a bibliometric analysis to examine post-pandemic health policy research, focusing on healthcare. These contributions – derived from several countries, including the United States, the United Kingdom, Canada, Australia, and Italy – highlight crucial aspects of the pandemic, including the role of trust in shaping effective policy responses and valuable lessons learned from comparative health policy experiences in different contexts. Armini, *et al.*, promoted that access to health messages, particularly using social media on adherence to health protocols to prevent COVID-19 transmission, still needs to be carried on by the government. Although fewer people accepted the government policy for preventing COVID-19, they still conducted fair health protocols in their daily activities. Given our preference that COVID-19 is now becoming endemic yet to other environmental-based diseases.

At the same time, multiple pieces of evidence in this issue also anticipate the environmental dan public health system for future preparedness. Triratnawati, *et al.*, established the preventive behavior for breast cancer. Since Yogyakarta has the highest incidence rate of breast cancer in Indonesia, this study was conducted in this setting resulting their preventive measures included medical (early examination, breast self-examination, laboratory check, or consultation with the doctor) and non-medical (changes in eating and drinking behavior, reducing stress, exercising, and wearing masks). Besides, they also made religious efforts by praying to God to be given a healthy life and for the patients to be healed and their offspring to be free from this disease. Rahmiwati, *et al.*, indicated that anemia in female adolescents is associated with nutritional status. This meta-analysis showed that nutrition education affected the risk of anemia in female adolescents divided into two groups of 10-19 and 15-49 years. The study suggests that the government should pay close attention to the importance of nutrition education for young women to raise nutrition knowledge and avoid anemia. Wahyuni, *et al.*, proposed the therapeutic exercise educational videos can be an option for delivering a rehabilitation program for post-COVID-19 hospitalized patients. These videos at home exercises may enrich the telerehabilitation method with its cost-effectiveness and efficiency compared to the conventional method. However, tailored work should be carried on to measure the long-term effect of this innovative program. Nurcandra, *et al.*, investigated poor individual, family, and community resilience to be a risk for poor quality of life in a productive-age population. Being grateful, sincere, patient, mutually reinforcing, accepting circumstances, implementing health protocols, emotional-cognition regulation, adaptability, and optimism were determined as the role of individual resilience that affected the quality of life in this sub-group of age in this study. Reshaping the education and health system that may be needed to control these study findings' indicators in achieving a better quality of life in the future. Yulinda, *et al.*, enclosed that experiential learning by having both creative and economically valued activities, such as making oil-based soap, can improve adolescent mental health during the pandemic situation. This innovative experiential learning facilitated metacognition, shaped cognitive processes, improved performance and problem-solving, and made learning more meaningful and authentic. Timanta, *et al.*, resulted age, work duration, and the use of ear protection devices (personal protective equipment/PPE) correlated with hearing loss in workers in the power service area of the airport, which is evidence that may lead to anticipate hearing loss in a future activity of workers in airport, particularly in welcoming the new normal. Rusli, *et al.*, determined the levels of depression, anxiety, and stress among academicians as well as their work-related stressors and coping strategies between a selected public university in Malaysia and a private university in Indonesia. At the same work-related stressor, this study found these mental conditions were higher among Malaysian rather than Indonesian academicians. It suggests that coping strategies toward mental resilience should be enforced at every level of management since both countries had been regulated in a similar manner. Herawati, *et al.*, proposed an initial pilot study in utilizing Rapid Molecular Tests (RMT/RIF) in tuberculosis drug-sensitive/resistant discovery in Indonesia. Although there was an increase in the use of MTB/RIF in the detection of suspected TB cases in health facilities, there was a decrease in finding cases of resistance to rifampicin. This study attests that these results may be affected by many suspected TB cases that were examined by RMT but not recorded, including the possibility of changing or moving officers, which may affect the health facilities in several study sample areas, impressed to further research in supporting the case detection/notification rate for this disease. Haddadi, *et al.*, explored the demographic, serological, and histological characteristics of celiac disease in Northern Morocco. This autoimmune disease which caused by gluten shows in multiple manifestations, so its diagnosis can be challenging. Given this epidemiological report, celiac disease predominantly affects adult females, and tTGA antibodies are commonly used for screening, although histology remains the definitive diagnostic method. Therefore, expanding more evidence is essential, particularly its importance for early detection for mitigation programs and strategies in the future. Wahyuningrum, *et al.*, proposed the Kangaroo Mother

Care procedure to improve the temperature thermoregulation status of premature babies, especially during COVID-19. Such an innovative method by the mother that can also be conducted by other families, including the father, in controlling the babies' body temperature so that those babies could be safe from their vulnerable and immature immune systems during the neonatal life phase.

Overall, the studies presented in the 2023 Special Issue offer valuable insights into the environmental and public health preparedness for the next threat. Given the vagueness of future challenges and its association with other public health issues, more attention should be taken into account to address the correlation of the community-health-environment system. Amid the uncertainty, future challenges of the global climate of business process will always be implicated to health outcomes. Therefore, the inclusiveness of the health system should be supported by the law product and enforcement, especially in achieving public health degree improvement.

Al Asyary,
Editor-in-chief

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Kesmas: Jurnal Kesehatan Masyarakat Nasional (Kesmas: National Public Health Journal)

Clinical and Functional Outcomes of COVID-19 Survivors After Hospitalization

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Abstract

Coronavirus disease 2019 (COVID-19) causes various clinical manifestations during acute infection and at the post-acute phase with persistent symptoms called long COVID. It occurs in mild and moderate to severe cases which require hospitalization. In patients needing hospitalization, especially intensive care unit admission, the risk of long COVID increases. Many hospitalized patients exhibited more symptoms in 60 days after the illness than non-hospitalized patients. This review aimed to identify the clinical and functional outcomes in COVID-19 survivors after hospitalization. The articles in the PubMed database published in 2019-2021 were reviewed and found 20 be eligible. The clinical outcomes were the appearance or persistence of general and multi-organ symptoms, nutritional disorders, and decreased lung function. The functional outcomes found were decreased muscle strength, physical, psychological, and cognitive functions, increased disability and dependencies, as well as decreased vocational status and quality of life. The incidence of each outcome could not be determined due to the variety of methods used to examine and present outcomes. To conclude, COVID-19 causes long-term clinical and functional outcomes that need to be identified to prevent and manage long-term physical and functional disorders.

Keywords: COVID-19, hospitalization, post-acute COVID-19 syndrome, quality of life, survivor

Introduction

Coronavirus disease 2019 (COVID-19) causes various clinical manifestations. The World Health Organization classifies the severity of this disease into mild, moderate, severe, and critical.[1] The severity of the disease increases the need for hospitalization, intensive care unit (ICU) admission, and even mortality.[2] People with a comorbid for COVID-19 have a higher risk for more severe disease.[3] In addition to causing various symptoms during acute infection, COVID-19 has long-term effects on survivors. This condition is called post-acute sequelae of COVID-19 or long COVID-19 (LC). The LC is a patient with signs and symptoms that persist for about 4-12 weeks or appear after the acute phase (≥12 weeks).[4] Clinical outcomes (CO) and functional outcomes (FO) of COVID-19 survivors can be affected. A review by Hayes, *et al.*,[5] found over 100 persistent symptoms after COVID-19 infection. Reported symptoms include cardiovascular, pulmonary, respiratory, fatigue, pain-related symptoms, generalized infection symptoms, psychological disorders, cognitive impairment, sensory disturbances, skin problems, and impaired function.[5]

A previous study have shown that LC not only occurs in patients with moderate to severe cases which require hospitalization but also in mild cases.[6] However, the risk of post-intensive care syndrome (PICS) was increased in patients needing hospitalization, especially ICU admission.[7] One systematic review found that a large proportion of hospitalized patients exhibited one or more symptoms of LC at 60 days after the illness compared to non-hospitalized patients.[8] Thus, this review study aimed to identify the CO and FO in COVID-19 survivors after hospitalization to give the knowledge or to develop a rehabilitation program for COVID-19 survivors.

Method

Articles were searched in the PubMed database with keywords ('functional' OR 'clinical') AND ('status' OR 'outcome') AND ('severe' OR 'critical') AND ('COVID-19') AND ('survivor') for the period from September 2021 to October 2021. The article type was an original article published from December 2019 to October 2021. Inclusion criteria were original articles with the study subjects of COVID-19 survivors after being discharged from the hospital, written in English, and freely accessi-

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ble in pdf or HTML format.

The identical articles were identified first, then reviewed based on title, abstract, and keywords. Data taken were the author(s), study design, total subject, outcome assessment period, CO, and FO. Data were synthesized narratively and displayed as a table and text. The CO synthesized was based on symptoms, physical examination, laboratory, and imaging findings, while FO was determined based on functional impairment, disability, and quality of life.

Results

A total of 1,053 articles based on keywords searched and 40 articles matched with eligibility criteria. After reading the full text, 27 articles explaining both CO and FO were found. The study types were a prospective cohort (n = 20), a retrospective cohort (n = 5), an ambi-directional cohort (n = 1), and a cross-sectional (n = 1) study. Twenty prospective cohort studies were analyzed as a final result. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart for a systemic review (Figure 1) was used to explain the results. The result summary is presented in Table 1.

Discussion

Most studies were conducted in the first few months of 2020. During this period, COVID-19 was known to be caused by the original variant of severe acute respiratory system coronavirus 2 (SARS-CoV-2) with various clinical and functional outcomes.

Clinical Outcomes of COVID-19

The Appearance or Persistence of General Symptoms

The most common symptoms reported by COVID-19 survivors after one month to one year after being discharged from the hospital were shortness of breath and fatigue. The presence of persistent symptoms in COVID-19 survivors is caused by several mechanisms, including the presence of SARS-CoV-2 and a persistent inflammatory response in various tissues, reactivation of neurotrophic pathogens when immune dysregulation occurs, interactions of viruses with the microbiome or virome of the host cell, blood coagulation problems,

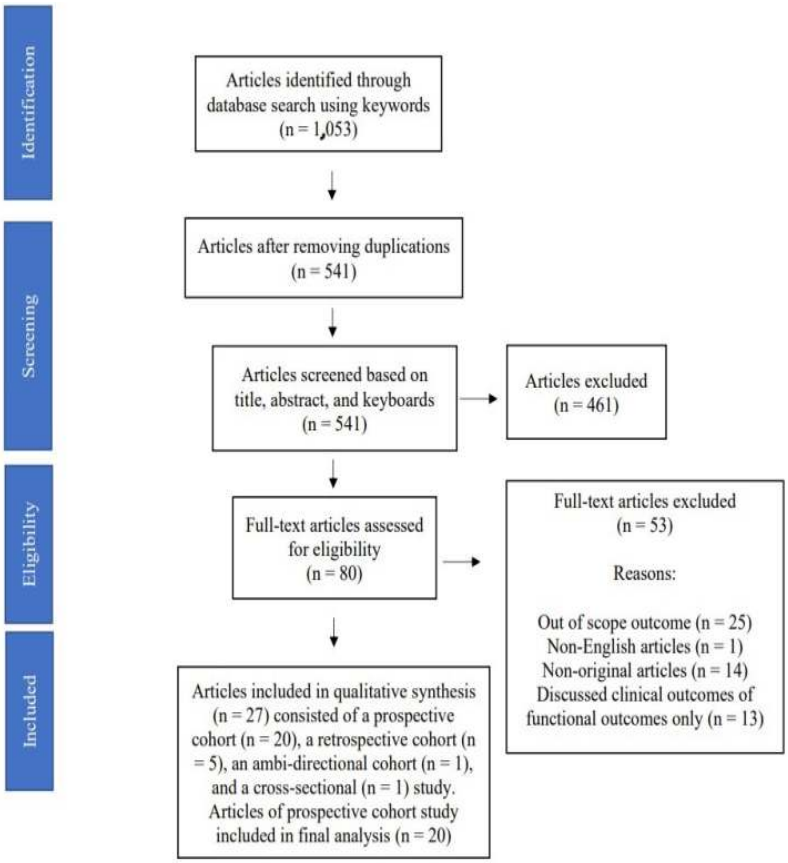

Figure 1. PRISMA Flowchart for the Systematic Review

Table 1a. Summary of Clinical and Functional Outcomes of COVID-19 Survivors After Hospitalization

Author (s)	Total Subject	Result	
		Clinical Outcome	**Functional Outcome**
Martillo, *et al.*[9]	45	Fatigue	• PICS • Upper and lower extremity function abnormalities • Minimal, mild, moderate, moderate-severe, severe depression, PTSD, insomnia, anxiety • Cognitive impairment • Disability • HRQoL: mobility, pain/discomfort, self-care, usual activities
Hall, *et al.*[10]	200	• Dyspnea • Impaired ventilation (FVC and DLCO)	• Increase exertional desaturation during 6MWT • Depression, anxiety
D'Cruz, *et al.*[11]	119	• Fatigue, dyspnea with persistent cough and burdensome pain, especially in the shoulder, chest, lower extremity, and back, and sleep disturbance	• Decreased four-minute gait speed • Decreased lower body muscular strength and endurance • Increase exertional desaturation by ≥4% and to SpO2 ≤88% during sit-to-stand test • Depression, anxiety, PTSD • Cognitive impairment
Cao, *et al.*[12]	62 at 1 month; 61 at 3 months	• Cough, dyspnea, fatigue • Impaired ventilation (FEV1, FVC, MVV under predicted value)	• 6MWT: decreased exertional capacity • HRQoL: impaired domains of the physical or emotional role and social function
Monti, *et al.*[13]	39	• Alteration in taste or smell, dyspnea at exertion • Malnutrition, at risk for malnutrition	• Cognitive impairment • Psychological disorders: anxiety and depression, PTSD, and insomnia. • Overall HRQoL showed no difficulty in mobility, self-care, usual activities, and anxiety/depression. Moderate pain/dis comfort by 41%. • More than half of patients who were previously employed did not return to their work.
Strumiliene, *et al.*[14]	51	• Fatigue, decreased physical activity, dyspnea at exertion, asthenia, cough, arthralgia, hair loss, headache, insomnia • Decrease pulmonary function test parameters (FVC, FEV1, TLC, VC, DLCO)	• 6MWT: decreased exertional capacity, increase exertional desaturation • Decrease HRQoL score in all domains
Schandl, *et al.*[15]	113	• Psychological disorder: PTSD, anxiety, depression • Decrease TLC and DLCO	• Impairment in all domains of HRQoL • Decreased exertional capacity • Returned to full-time work
Van Gassel, *et al.*[16]	46	• Fatigue • Decreased DLCO	• Decreased exertional capacity • Decreased HRQoL • Muscle weakness, ICU-AW • Anxiety and depression • Cognitive impairment
González, *et al.*[17]	62	• Dyspnea, muscle fatigue, cough • Decreased DLCO and TLC	• HRQoL: decreased • 6MWT: decreased exertional capacity • Psychological disorder: anxiety and depression
Todt, *et al.*[18]	251	Dyspnea	• Anxiety/depression • Impairment in all domains of HRQoL
De Lorenzo, *et al.*[19]	251	Tachypnea, dyspnea	• Anxiety, insomnia, PTSD • Decreased HRQoL
Rousseau, *et al.*[20]	32	Abnormal estimated glomerular filtration rate	• Decrease of peripheral muscle strength • Poor sleep quality, PTSD • Cognitive impairment • Dependency • Did not return to their previous level of activity

Notes: 6MWT = Six-minute Walk Test, DLCO = Diffusing Lung Capacity for Carbon Monoxide, FEV1 = Forced Expiratory Volume at 1 s, FVC = Forced Vital Capacity, HRQoL = Health-Related Quality of Life, ICU-AW = Intensive Care Unit-Acquired Weakness, MVV = Maximal Voluntary Ventilation, PICS = Post-intensive Care Syndrome, PTSD = Post-traumatic Stress Disorder, TLC = Total Lung Capacity, VA = Alveolar Volume, VC = Vital Capacity.

dysfunction of vagal nerve signaling, abnormal cell metabolism, the presence of primitive immune cell activity, and molecular mimicry leading to autoimmunity between pathogens and host cells.[29-30]

The Appearance or Persistence of Multi-organ Symptoms

Angiotensin-converting enzyme 2 (ACE2), employed by SARS-CoV-2 as a receptor to enter human cells, is abundant in lung epithelial cells, especially in the alveoli. However, ACE2 is also widespread in various organs,

Table 1b. Summary of Clinical and Functional Outcomes of COVID-19 Survivors After Hospitalization

Author (s)	Total Subject	Result	
		Clinical Outcome	**Functional Outcome**
Sigfrid, *et al.*[21]	327	Fatigue, dyspnea, sleeping problems, headache, limb weakness, myalgia, arthralgia or swelling, dizziness/lightheadedness, balance problems, swollen ankle, palpitations, seeing problems, constipation, stomach pain, diarrhea, persistent cough, chest pains, pain on breathing, anosmia, persistent fever, ageusia, nausea/vomiting, swallowing problems, skin rash, passing urine problems, hemiplegia/paresthesia, toe lesions, weight loss	• Anxiety/depression • Disability in walking or mobility, memory, and concentration • Decreased overall domains of HRQoL
Latronico, *et al.*[22]	114 evaluated at least once; 69 at least twice; 43 three times	• Fatigue, ICU-AW • At risk of malnutrition or being malnourished • Decreased DLCO	• 6MWT: abnormal • Decreased handgrip strength at 3 months, abnormal global muscle strength at 3, 6, and 12 months • Anxiety, depression, PTSD at 3 months • Cognitive impairment • Dependency at 3 and 6 months, and independency at 12 months • Return to work at 3, 6, and 12 months, reduced effectiveness at work at 3 and 6 months, not return to work at 3, 6, and 12 months
Boari, *et al.*[23]	94	• Lamented fatigue, effort dyspnea, anorexia, dysgeusia or anosmia, insomnia • Alteration in DLCO	• Anxiety
Bellan, *et al.*[24]	238	• Dyspnea, ageusia, anosmia, arthralgia, myalgia, cough, diarrhea, chest pain • Decreased DLCO	• 2-minute walk test: 40.5% outside reference ranges of expected • Mild, moderate, severe PTSD • Mobility: limited
Guler, *et al.*[25]	66	• Exertional dyspnea • Had generally lower lung volumes, decreased DLCO	6MWT: decreased exertional capacity, increase exertional desaturation
Veenendaal, *et al.*[26]	50	• Fatigue, weakened condition, polyneuropathy, dyspnea, muscle weakness/stiffness, shoulder pain, restriction of extremities, difficulty sleeping, walking, impaired hand function • Weight loss • Impaired ventilation (FEV1, FVC under predicted value), decreased DLCO under predictive value	• Cognitive impairment • 10% no change in work, 13% reduced work rate, 10% occupation change, 13% re-integration, and 43% too ill to work
Lombardo, *et al.*[27]	189	Fatigue and weakness, myalgia and arthralgia, sleep disorders, respiratory disorders, sensory alterations, gastrointestinal symptoms, movement impairments	Neurocognitive impairments
Bertolucci, *et al.*[28]	39	Dysphagia, peripheral nervous system impairment	• Delirium • Total Dependency • Cannot walk

Notes: 6MWT = Six-minute Walk Test, DLCO = Diffusing Lung Capacity for Carbon Monoxide, FEV1 = Forced Expiratory Volume at 1 s, FVC = Forced Vital Capacity, HRQoL = Health-Related Quality of Life, ICU-AW = Intensive Care Unit-Acquired Weakness, MVV = Maximal Voluntary Ventilation, PICS = Post-intensive Care Syndrome, PTSD = Post-traumatic Stress Disorder, TLC = Total Lung Capacity, VA = Alveolar Volume, VC = Vital Capacity.

such as the heart, intestines, and kidneys.[31] Therefore, the virus can persist and damage various organs, resulting in other manifestations, both during the acute phase and after the patient recovers. Autoimmunity is also known to cause inflammation and damage in various organs.[29] One study found an abnormal estimated glomerular filtration rate.[20] Acute kidney failure is one of the complications due to COVID-19, which has a prevalence of 17%, of which 77% have severe COVID-19, and 5% of the total patients require renal replacement therapy.[32] In addition to the kidneys, abnormal results were found in cardiovascular organs, gastrointestinal, and neurological tissue.[32]

Decreased Lung Function

Various studies carried out pulmonary function tests on COVID-19 survivors. They found that ventilation was impaired through a decrease in forced vital capacity and forced expiratory volume in one second, a decrease in total lung capacity, and a decrease in diffusion capacity.[10,12,14-17,22-26] COVID-19 survivors needed a long period to recover due to lung fibrosis and other morphological changes fully. The recovery rate is affected by the severity level, which is affected in turn by gender, obesity, and the presence of comorbidities.[14] Predominant impairment of lung function is a restrictive pattern with

a reduction of diffusing capacity for carbon monoxide (DLCO) value.[14]

Nutritional Disorders

Nutrition-related problems that arise in COVID-19 survivors, especially severe degrees of disease, are caused by other related manifestations.[33] Difficulty of swallowing and weakness can make it difficult for the patient to eat. This condition is exacerbated by reduced appetite, resulting in muscle wasting.[33] In the end, survivors reported a weight loss of >5% of their pre-illness body weight.[34] In other survivors, the diagnosis of malnutrition was established. Moderate to severe malnutrition is the most common diagnosis.[35]

Functional Outcomes of COVID-19

Decreased Muscle Strength

Decreased muscle strength may occur due to chronic skeletal muscle damage by SARS-CoV-2.[36] In addition, muscle weakness can be the result of immobility that occurs during hospitalization.[37] Prolonged ICU stay or mechanical ventilation used increased the occurrence of ICU-related muscle weakness.[20,22]

Decreased Physical Performance

The 6MWT was the most frequently used method to determine decreased exercise capacity and increased exertional desaturation post-COVID-19.[10,12,14-17,22,25] Wong, *et al.*, described that in patients who had exertional desaturation or hypoxemia (reduced SpO2 ≥4%), 45% had walking distance less than the lower limit of normal on the 6-minute walking distance, and 100% had DLCO less than the lower limit of normal.[38] These results suggest that desaturation during exercise is associated with pulmonary vascularity.[38]

Psychological Disorder

Anxiety and depression were the most frequently reported psychological disorders in COVID-19 survivors, especially those requiring hospitalization.[39] Mental health disorders occur due to direct neuro-invasion by viruses that cause nerve cell damage or due to immune activation that causes an inflammatory response, especially in the brain.[39] In addition, having to undergo isolation makes it difficult to meet family and the inability to carry out normal activities, as well as guilt toward those closest to them because they have increased the risk of exposure to disease, all of which become stressors for the emergence of symptoms of anxiety and depression.[40]

Cognitive Impairment

Not all literature describes methods for assessing the presence of cognitive impairment. However, in some literature that explains this, the Montreal Cognitive Assessment method was found to be the most widely used method to assess cognitive impairment. Similar to psychological disorders, cognitive impairment is also caused by damage to neurological function and the immune system.[32,39] In addition, patients undergoing treatment in hospitals do not receive stimulation and cognitive reorientation due to limited interactions between humans.[40] Cognitive symptoms that arise post-COVID-19 include difficulty thinking and concentrating (brain fog), decreased memory, and difficulty carrying out executive functions.[37] Any disturbances in physical, mental health, and cognitive functions cause post-intensive care syndrome, seen in individuals who have had treatment in an intensive care unit.[7]

Increased Disability and Dependency

Physical impairments that arise are related to the treatment given in the acute phase.[40] The more severe the severity of the disease, the more complex the treatment given in the hospital. Severe disease increases the likelihood of mechanical ventilation, sedation, and neuromuscular blockade associated with prolonged immobilization.[40] Subsequent immobilization causes muscle and joint contractures, making it difficult for the patient to move. These disabilities make survivors dependent on carrying out daily activities. The Short Physical Performance Battery test method can be used to measure mobility ability through walking speed, Functional Ambulatory Category for walking/ambulation ability, and Barthel Index to determine individual dependence in daily activities.[40]

Decreased Vocational Status

COVID-19 infection caused a significant reduction in return to workability.[13,15,20,22,26] Several studies found that 50% to 87.5% of COVID-19 survivors did not return to their previous work or activity.[13,15,20] One study found that 43% of COVID-19 survivors felt too ill to work.[26] Among survivors who returned to work, many experienced a reduction of work capacity.[22,26]

Decreased Health-Related Quality of Life

Most studies found that all domains of HRQoL decreased in COVID-19 survivors after hospitalization.[12-19,21] Short-form 36 items and European Quality of Life 5 Dimension were the most common HRQoL assessment instruments.[12-16,18,19,21] The decrease in HRQoL was associated with symptoms, especially shortness of breath and fatigue, decreased physical performance, stress in family and work, and social isolation.[12-14,16] The decrease in physical performance was associated with decreased pulmonary function.[16]

Conclusion

The CO identified in several studies is the appearance or persistence of general symptoms, multi-organ symptoms, decreased lung function, and nutritional disorders, while the FO includes decreased muscle strength and physical performance, psychological or cognitive disorders, increased disability or dependency, as well as decreased vocational status and HRQoL. With various methods used to examine the CO and FO of COVID-19 survivors after hospitalization and not all literature being equipped with a percentage of each outcome, the authors could not determine the incidence of each outcome. Further studies need to elucidate the incidence and differential outcomes associated with each variant of SARS-CoV-2 and their specific mechanisms. After knowing these outcomes, medical personnel are expected to be able to assess the CO and FO of COVID-19 patients to be used as a basis for carrying out rehabilitation management. Good cooperation between medical personnel and survivors is needed to improve the HRQoL and prevent persistent anatomical and physiological damage to the body.

Abbreviations

COVID-19: coronavirus disease 2019; ICU: Intensive Care Unit; LC: Long COVID, CO: Clinical Outcomes; FO: Functional Outcomes; PICS: Post-intensive Care Syndrome; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; ACE2: Angiotensin-Converting Enzyme 2; DLCO: Diffusing Lung Capacity for Carbon Monoxide; 6MWT: Six-minute Walk Test; HRQoL: Health-Related Quality of Life.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The authors declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Not applicable.

Authors' Contribution

AN, SSSP, and MHB contributed to all conception, analysis, and interpretation of results, as well as writing the manuscripts and revising them. All authors read and agreed to the final version of the submitted manuscript.

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Rehabilitation Management to Improve Respiratory Function in Severe and Critical COVID-19 Survivors: A Literature Review

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Abstract

Post-acute COVID-19 symptoms impact the quality of life, and pulmonary rehabilitation is recommended. This study explored the implementation, outcomes, and barriers of such programs for severe and critical COVID-19 survivors, focusing on improving respiratory function. Articles search was conducted from October to November 2021 through Google Scholar and PubMed databases. Pulmonary rehabilitation programs in severe and critical cases of COVID-19 survivors have a similar purpose in other respiratory cases. Pulmonary rehabilitation programs, including breathing, resistance, stretching, cardiorespiratory endurance exercises, respiratory physiotherapy, relaxation techniques, and education, significantly improved lung function and reduced symptoms. No studies exploring barriers to pulmonary rehabilitation were found. In conclusion, pulmonary rehabilitation programs for COVID-19 survivors with severe and critical cases have improved respiratory functions.

Keywords: breathing, exercise, physiotherapy, pulmonary rehabilitation, quality of life

Introduction

Coronavirus disease 2019 (COVID-19) is a global health issue with clinical manifestations that can develop into severe, critical, or even death, especially for older individuals and those with comorbidities.[1,2] COVID-19 survivors often experience post-acute COVID-19, which can be classified into subacute (symptoms persisting for 4-12 weeks) and chronic (persisting for more than 12 weeks).[3,4] Common symptoms include shortness of breath and fatigue, affecting various organ systems.[4,5]

Post-acute COVID-19 is attributed to multiple factors, including the invasion of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), leading to pulmonary fibrosis and reduced lung function.[4,6-8] Microvascular thrombosis, the immune system-induced tissue damage, inflammation, and cytokine storm contribute to organ dysfunction and complications.[4,6,7,9]

Pulmonary rehabilitation (PR) is recommended for severe and critical COVID-19 survivors to improve respiratory function and quality of life (QoL). The PR programs with exercise as one of the core components are administered to relieve symptoms, restore functional abilities, and reduce disability in order to improve overall QoL.[4,10] This was the first review to specifically explore pulmonary rehabilitation in managing respiratory function disorders in severe and critical COVID-19 cases. The potential benefits of PR in improving respiratory function and QoL for severe and critical COVID-19 survivors were highlighted. This study explored PR implementation, outcomes, and barriers, providing insights for health professionals and policymakers in managing long-term COVID-19 effects and emphasizing comprehensive care for post-acute patients.

Method

Articles were searched using the Google Scholar and PubMed databases with the following keywords: (1) ("COVID-19" or "COVID-19" or "2019-nCoV") and ("Rehabilitation"), (2) ("COVID-19" or "COVID 19" or "2019-nCoV") and ("Rehabilitation") and ("Barrier" or "Challenge"). The article type was an original research article and case reports published from October to November 2021. Inclusion criteria were proofread or published articles written in English and accessible in pdf

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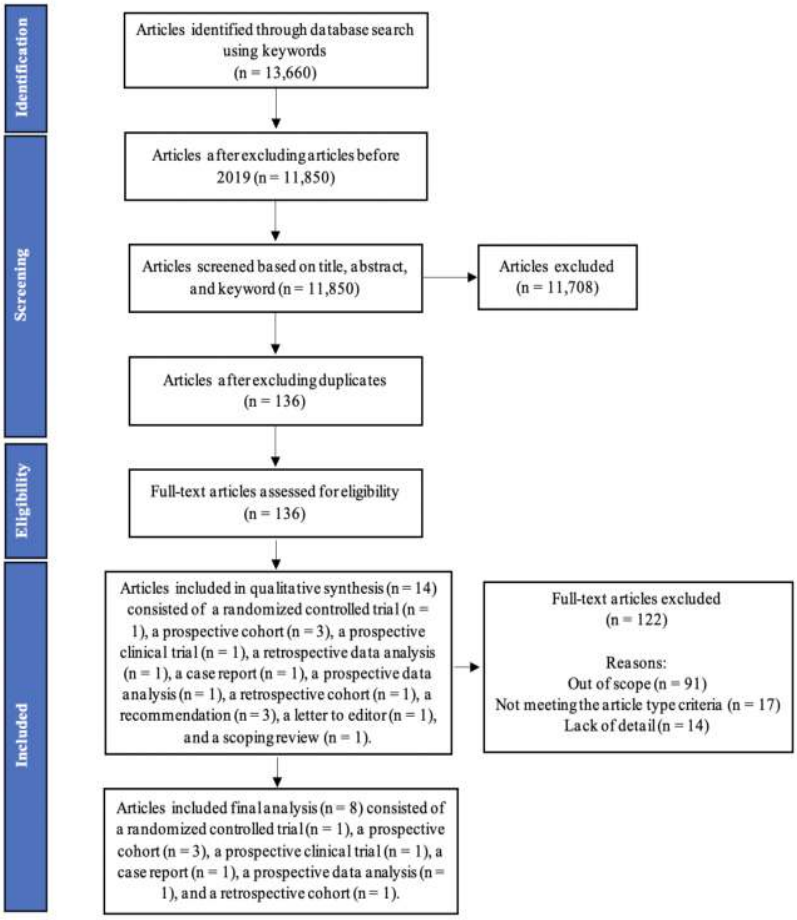

Figure 1. PRISMA Flowchart for the Literature Review

or HTML format. The articles were initially selected based on their titles, abstracts, and keywords. After reading the whole text, data were displayed as text and table.

Results

Eight articles discussing the implementation and outcomes of PR were found and no articles discussing barriers. The literature search flow based on preferred reporting items for systematic reviews and meta-analyses is shown in Figure 1, and the summary of PR interventions and outcomes is shown in Table 1.

Discussion

Implementation of Pulmonary Rehabilitation

COVID-19 survivors often experience residual symptoms even though they have been cured.[3,4] The PR program can be prescribed for COVID-19 survivors, especially in severe and critical cases, to relieve symptoms, improve quality of life, improve respiratory muscle function, and relieve symptoms of anxiety and depression.[13] The PR program for COVID-19 survivors includes breathing exercises, strength and stretching exercises, cardiorespiratory endurance exercises, respiratory physiotherapy, and relaxation technique.[11-18] Other interventions are psychological support, psychotherapy, nutritional counseling, occupational therapy, and activity of daily living exercises in calisthenics, speech therapy, and swallowing.[12,13,16-18] One article recommends mobilization, such as free and paced walking, balance, and aerobic exercise.[15]

Breathing exercises need to be carried out for COVID-19 survivors, especially in severe and critical cases, because lung function decreases in response to a cytokine storm in the acute phase. Decreased lung function is caused by impaired lung expansion due to alveolar damage to pulmonary fibrosis.[7,8] The intensive care unit care is involved in critical cases that cause the patient to experience muscle weakness related to mechanical ventilation, which significantly accelerates

Table 1. Summary of Articles Regarding Rehablitation Intervention and Outcomes in Managing Respiratory Function Disorders in Severe and Critical Cases of COVID-19 Survivors

Author (s)	Year	Study Design	Rehabilitation Management	Outcome
Liu, *et al.*[11]	2020	Randomized controlled trial	PR consisted of respiratory muscle, cough, diaphragm, stretching, and home exercises.	Significant improvement in lung function (FEV1, FVC, FEV1/FVC, and DLCO) in the intervention group.
Gloeckl, *et al.*[12]	2021	A prospective, observational cohort study	Comprehensive PR, including medical diagnostics and treatment, resistance training, strength training, patient education, respiratory physiotherapy, activity of daily living exercises, relaxation techniques, occupational therapy, psychological support, and nutritional counseling, is carried out for three weeks.	1. Significant lung function improvement in a group of mild/moderate COVID-19 and severe or critical. 2. Dyspnea, fatigue, and cough persist after completing PR in severe/critical COVID-19.
Sun, *et al.*[13]	2021	Before-after self-control prospective clinical trial	Breathing method exercises, respiratory muscle training, stretching exercises, and psychotherapy.	Dyspnea decreased, oxygen intake decreased, and oxygen saturation increased after 2- and 3-week PR.
Shan, *et al.*[14]	2020	Case report	PR focusing on increasing activity tolerance and endurance was performed for 10 days.	Improvement in oxygen saturation during excercise tests and incentive spirometer volume after PR.
Spielmanns, *et al.*[15]	2021	Prospective data analysis	PR includes endurance training, gymnastics, walking exercises, strength training, inspiratory muscle training, relaxation, and respiratory physiotherapy.	1. Oxygen supply was needed in 53% and 25% of patient before PR and after PR, respectively. 2. About 18 (26%), 12 (17%), 28 (41%), and 11 (41%) patients had no mild, moderate, or severe ventilation restrictions at the end of PR, respectively. 3. Diffusion capacities were normal, mild-, moderate-, and severe-limited in 9 (13%), 14 (20%), 28 (41%), and 18 (26%) patients, respectively.
Büsching, *et al.*[16]	2021	Retrospective cohort study	PR includes cardiopulmonary exercise, strength training, oxygen supply when needed, breathing exercises, relaxation techniques, and, if indicated, psychological counseling, speech therapy, nutrition, occupational therapy, and social services can be provided.	1. Significant CRQ in the COVID-19 and common pneumonia patient groups. 2. COVID-19 patients had similar outcomes in CRQ after PR compared to common pneumonia.
Hayden, *et al.*[17]	2021	Prospective observational study	PR program includes: 1. Physical exercise includes endurance, strength, whole-body vibration, and inspirational muscle training. 2. Respiratory physiotherapy 3. General physiotherapy 4. Education about COVID-19 5. Routine medical diagnosis 6. Close medical supervision 7. Psychosocial support 8. Nutrition counseling 9. Occupational therapy	1. Exertional dyspnea • Moderate to large changes in exertional dyspnea between pre-and post-PR. • A clinically relevant improvement of dyspnea in 66.1% of patients. • No correlations between the improvement in exertional dyspnea and lung function parameters such as VC, TLC, FEV1, PImax, and PaO2. 2. MMRC scores • Moderate changes between pre- and post-PR. • A clinically relevant improvement in more than 50% patients. 3. Dyspnea at rest: small to moderate changes in the intensity of dyspnea at rest.
Puchner, *et al.*[18]	2021	Observational cohort study	PR includes respiratory therapy, respiratory muscle training, endurance and strength training, speech therapy and swallowing evaluation, occupational therapy, psychological therapy, nutritional counseling, and passive therapy sessions.	1. A significant improvement in respiratory muscle strength after PR. 2. A significant improvement in lung functional parameters including FEV1, FVC, TLC, and DLCO during PR. 3. Lung function was still impaired in 57% of all patients. 4. A reduction of the DLCO at the end of PR in 83% of patients.

Notes: COVID-19 = coronavirus disease of 2019, CRQ = Chronic Respiratory Questionnaire, DLCO = Diffusing Lung Capacity for Carbon Monoxide, FEV1 = Forced Expiratory Volume in 1 Second, FVC = Forced Vital Capacity, MMRC = Modified Medical Research Council, PaO2 = Partial Pressure of Oxygen, PImax = Maximal Inspiratory Pressure, PR = Pulmonary Rehabilitation, TLC = Total Lung Capacity, VC = Vital Capacity.

and exacerbates respiratory muscle dysfunction.[4]

Sun, *et al.*,[13] applied the breathing method as the core of PR by adopting the 3-5-6 breathing method, three seconds of deep inspiration, then holding breath for three

to five seconds and slowly exhaling for six seconds. This exercise can be performed in a lying or standing position and is performed for three to four breath cycles per set with 30-60 seconds of rest, depending on the symptoms of shortness of breath.[13] Zhao, *et al.,* mentioned that breathing exercises include posture management, breathing rhythm adjustment, thoracic expansion exercises, respiratory muscle mobilization, etc.[19]

Several articles also recommend respiratory muscle training as a component of PR.[11,13,17,18,20] Respiratory muscle exercises, especially inspiratory muscles, can be performed in patients with inspiratory muscle weakness and can be performed with a frequency of up to two times a day.[13,17] Respiratory muscle exercises are carried out by inhalation and exhalation slowly to make the thorax expand, using diaphragmatic breathing and mobilization of the respiratory muscles for 15 minutes each in the right and left lateral decubitus positions alternately and followed by a supination position with a bridge exercise, alternating straight leg, air pedal, and ankle pump.[13,20]

These exercises can also be performed using a commercial hand-held resistance device with ten breaths per set and performed in three sets using a positive expiratory pressure device if necessary.[11,20] Liu, *et al.,* stated that diaphragmatic exercises are performed with 30 maximal voluntary contractions of the diaphragm plus a 1-3 kg load on the anterior abdominal wall.[11] Based on the articles that discussed respiratory muscle training in COVID-19 survivors, no standard exercise has been found.[11,13,16-20]

Almost all the literature found includes strength training or limb resistance exercise as a PR component.[12,15-21] Strength training is performed using a strength training machine for approximately 30-60 minutes per session and five days a week. The resistance training includes butterfly forward/backward, rowing, back extension, abdominal trainer, weight training using machines, free weights, elastic resistance bands, latissimus pull, cable pull, and robotic arm training.[12,17,18,20,21] Neuromuscular electrical stimulation can be used to help strengthen muscles.[21] Patients undergo one to three sets of each exercise with 8-12 repetitions per set and two minutes of rest between sets with increasing intensity.[12,17,19]

Spielmanns, *et al.,* declared that gymnastics can improve strength, endurance, coordination, range of motion, and balance.[15] Leg muscle strength training in COVID-19 survivors is carried out because of the cytokine storm in the acute phase of COVID-19, which causes damage to various organs, such as the dysfunction of skeletal muscles in the extremities,[7] which can worsen secondary to inactivity and immobilization.[4] The symptoms of fatigue and shortness of breath in COVID-19 survivors can cause survivors to limit their activities.[4,5]

Stretching exercises are also recommended in PR, which consist of exercises in the upper and lower extremities that aim to improve muscle function, especially joint flexibility, the lack of which can prevent activities. Stretching exercises can also be combined with strength training in upper and lower extremity functional activities, including upward lift, lateral lift, abduction, chest enlargement and grasping, lifting, kicking, tiptoeing, and stepping.[11,13]

Fatigue and shortness of breath are the most common complaints found in COVID-19 survivors.[4,5] These symptoms are caused by damage to various organs that lead to a decrease in cardiorespiratory fitness.[22] Based on this review, it was found that cardiorespiratory endurance exercises are a major PR component. Endurance training can be done by cycling at varying times, ranging from 10 to 60 minutes per session, and performed five to six times weekly.[12,15,17,18]

Gloeckl, *et al.*, discuss that exercise occurs at 60-70% of the peak work rate.[12] While, Puchner, *et al.*, stated that endurance training is performed based on the cardiopulmonary exercise test at 50% of the highest pressure sustained for one second.[18] The intensity of each exercise can change depending on oxygen saturation and pulse rate. Oxygen administration may be performed if indicated.[17]

Respiratory physiotherapy may vary from individual to individual. Physiotherapy is done twice to four times weekly for 30 minutes each session.[12] The techniques used in this physiotherapy include coughing techniques, mucus clearing, connective tissue massage, energy conservation techniques, learning about breathing (pursed lip breathing, secretion mobilization, and diaphragmatic breathing), mucolytic inhalation therapy, etc.[12,15,17] Liu, *et al.*, applied three sets of coughing exercises with 10 active coughs per set which can be done at home.[11]

Many psychiatric changes occur in COVID-19 survivors, such as post-traumatic stress disorder, depression, and anxiety.[23] Relaxation techniques can be included as a component of rehabilitation to reduce anxiety levels in COVID-19 survivors.[24] Gloeckl, *et al.*,[12] Spielmanns, *et al.*,[15] and Büsching, *et al.*,[16] also included relaxation techniques as part of PR. The relaxation technique is carried out by progressive muscle relaxation (Jacobson's technique) twice per week for 30 minutes.[12,15,16] Education as part of PR includes explanations about COVID-19 and general topics such as physical activity, oxygen therapy, and smoking cessation.[12] There was also an explanation about PR's importance in increasing patient compliance in undergoing rehabilitation.[16]This education can be done by direct exposure or using booklets and videos.[12,17,19]

Outcomes of Pulmonary Rehabilitation

The PR has been shown to improve lung function and symptoms of dyspnea in severe and critical COVID-19 survivors.[11-18] Liu, *et al.*, showed significant improvement in lung function, including FEV1, FVC, FEV1/FVC, and DLCO in the intervention group.[11] These results were consistent with Hayden, *et al.*, and Puchner, *et al.*, which showed a significant increase in vital capacity, FVC, TLC, FEV1, DLCO, and PImax after PR.[17,18] PR has also improved the partial pressure of oxygen, incentive spirometry volume, and decreased the need for oxygen support.[14,15,17] However, the persistence of dyspnea and fatigue after they underwent PR was found in many survivors.[12]

In addition, some symptoms, including exertional dyspnea, cough, fatigue, and phlegm production, also decreased.[13,17] Respiratory muscle exercise has increased diaphragmatic strength and endurance in COVID-19 survivors due to increased PImax.[17] Strength and endurance of the diaphragm and other respiratory muscles are associated with increased lung function.[11] Breathing exercises can also improve lung compliance and volume, which increases ventilation and gas exchange and further causes an increase in tidal volume, diaphragm capacity, and lung compliance.[13] Controlled breathing patterns and holding breath for a certain time decreased hypoxemia and local atelectasis.[13]

Improvement in symptoms is also caused by increased exercise capacity, exercise tolerance, and local muscle endurance as a result of a comprehensive PR program, as well as aerobic and resistance exercise.[11] Gloeckl, *et al.*,[12] discussing resistance exercise as part of PR showed a significant improvement in lung function (FEV1 and FVC) in severe and critical post-acute COVID-19 patients.

Barrier to Pulmonary Rehabilitation

No studies exploring barriers to pulmonary rehabilitation in COVID-19 survivors were found. Only one review by Wasilewski, *et al.*,[25] discussed barriers to PR, including COVID-19 infectivity, the varied health status of patients, lack of literature, insufficient PPE, problems related to rehabilitation staff, and health system issues. The varying degrees of severity of COVID-19 patients can be challenging in prescribing and initiating rehabilitation. Disability and the unstable condition of the patient can also become obstacles.[25] Korupolu, *et al.*, showed that the patient's ability to care for themselves and the caregiver's availability were inhibiting factors for rehabilitation in the outpatient unit.[21]

The high number of COVID-19 cases and limited PPE and staff are also obstacles to rehabilitation.[21,25] Wasilewski, *et al.*,[25] also mentioned that the problems of the rehabilitation staff, such as high workloads, declining staff health, and fear of being infected with COVID-19, could prove obstacles. The infectivity of COVID-19 is also one of the considerations in the implementation of the rehabilitation program.[21,25] Limited access to rehabilitation due to isolation procedures and the closure of rehabilitation centers has also occurred due to the increase in COVID-19, so the treatment focuses on the respiratory management of COVID-19 only.[25,26] Conversely, it is also difficult to implement the rehabilitation program to implement physical distancing. Families should also not be involved in the care of COVID-19 patients.[25]

The health system issue is a challenge for implementing the rehabilitation program. Lack of coordination at all health system levels limits rehabilitation implementation's effectiveness. Lack of funding to support telerehabilitation and other infrastructure, as well as very strict billing procedures that reduce the time and quality of patient care, also hinder the rehabilitation program implementation.[25]

This review specifically discussed the implementation, outcomes, and barriers of PR, even though the collected data were limited. This review can be used as a reference to explore more about this topic. However, there were some limitations, such as a limited database (only PubMed and Google Scholar), only written in English, and a short search period, so there are possible different outcomes if the review was done using more databases, not limited to English, and longer searching period. Future studies can be done by correcting these.

Conclusion

The PR program in severe and critical cases of COVID-19 survivors aims to improve the QoL by alleviating symptoms, restoring functional abilities, and reducing disability. The PR program includes breathing, strength, stretching, cardiorespiratory endurance exercises, respiratory physiotherapy, relaxation techniques, and education. Some articles stated that PR significantly improves lung function and reduces the symptoms.

Abbreviations

COVID-19: coronavirus disease 2019; PR: Pulmonary Rehabilitation; QoL: Health-Related Quality of Life; PPE: Personal Protective equipment; FEV1: Forced Expiratory Volume in 1 Second; FVC: Forced Vital Capacity; DLCO: Diffusing Lung Capacity for Carbon Monoxide; TLC: Total Lung Capacity; PImax: Maximal Inspiratory Pressure.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The authors declares that there are no significant competing financial, professional, or personal interests that might have affected the perform-

ance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data used in this study were publicly available in the Google Scholar and PubMed databases.

Authors' Contribution

AN contributed to the conception and design of the study. AN, RN, and SAW drafted the article or revised it critically for important intellectual content and final approval of the version to be submitted.

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Reshaping Healthcare: A Bibliometric Analysis of Lessons Learned in Post-COVID-19 Health Policy

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Abstract

The COVID-19 pandemic has profoundly impacted health policy globally, leading to heightened concern and urgency. However, previous studies have been hampered by limited resources and insufficient discussions on the long-term implications for health policies following multiple COVID-19 waves. Thus, this study examined the evolution of international studies on post-COVID-19 health policy. A comprehensive analysis used well-known literature databases Scopus and Web of Science to explore parameters including publication growth, participating countries, areas of interest, and keyword analysis of topics such as "COVID-19" and "Health Policy." The United States emerged as an active participant, focusing on "Computer science." Key themes included "COVID-19 Pandemic," "Public health policy," and "Epidemiology," highlighting current trends. It emphasized the significance of global cooperation and knowledge exchange in addressing the complex challenges posed by the pandemic and shaping resilient health policies for the future. The contribution of this study lies in providing a comprehensive overview of post-COVID-19 health policy study and its implications for the health field.

Keywords: bibliometric analysis, health policy, post-COVID-19

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had profound global impacts, unprecedentedly affecting health systems, economies, and societies. Originating in late 2019 in Wuhan, China, it quickly spread across continents, necessitating rapid and comprehensive responses from governments and organizations worldwide.[1] This crisis has highlighted the crucial role of effective health policy in managing and minimizing the consequences of such outbreaks. Governments and healthcare authorities have faced complex challenges, including devising containment strategies, ensuring equitable vaccine distribution, optimizing resource allocation, and balancing public health priorities with socioeconomic considerations.[2,3] A systematic review of the pandemic's lessons and its implications for health policy is vital. Such an assessment can provide valuable insights to enhance preparedness, response strategies, and the overall resilience of health systems in anticipation of future health crises.[4] By critically evaluating the successes, failures, and innovative approaches observed during the pandemic, policymakers can navigate future challenges more effectively and safeguard public health and well-being.[5]

Health policy is crucial in post-pandemic preparedness and response efforts. It guides governments and healthcare systems to establish robust strategies and frameworks to effectively prevent, detect, and respond to future health crises.[6,7] Lessons from the COVID-19 pandemic can inform the development of health policies that prioritize early detection systems and facilitate monitoring of the disease's geographical spread and the effectiveness of control measures.[8] Also, this pandemic provides valuable early warnings with lessons for building public health resilience.[9]

The COVID-19 pandemic has impacted health systems and policy frameworks, shaping the post-pandemic landscape. Governments and healthcare systems have witnessed the strain on healthcare infrastructure, resource limitations, and the need for increased flexibility and resilience.[10] Post-pandemic health policies should address these challenges by strengthening healthcare systems, enhancing capacity, and prioritizing investments in areas such as healthcare workforce development, infrastructure, and technology. Furthermore, the pandemic has highlighted the importance of integrating public health considerations into broader policy frameworks,

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including social determinants of health, health equity, and preparedness for future infectious diseases. As further support, social and health policies are necessary to ensure that the pandemic does not exacerbate health inequalities in the future.[11]

Evidence-based decision-making remains crucial in post-pandemic health policy development. As countries recover, policymakers must rely on robust scientific evidence, data-driven analysis, and evaluation of interventions to inform their policy choices.[12] It is essential to draw insights from the successes and failures of pandemic response strategies to design evidence-based policies that address emerging challenges. Additionally, fostering study collaborations, strengthening health information systems, and investing in health data collection and analysis is critical for evidence-based decision-making.[13] By adopting this approach, post-pandemic health policies can effectively address evolving health needs, support healthcare systems, and enhance the overall resilience of societies in future global crises.[14]

To address the aforementioned gaps in previous studies related to post-pandemic health policies, this study utilizes bibliometric analysis as a valuable tool. Bibliometric analysis facilitates a comprehensive assessment of scholarly literature, enabling the identification of trends, gaps, and emerging themes in the field. By systematically analyzing citations, publication outputs, and collaboration networks, bibliometric analysis provides insights into the research landscape and dissemination of knowledge. Furthermore, this study aimed to identify research gaps in the literature on post-pandemic health policies. The analysis will help pinpoint areas that have received less attention or require further investigation, ensuring a more focused and targeted approach to future study endeavors. By understanding these gaps, the study can contribute to filling the knowledge voids and generating new insights in the field.

Method

Bibliometric analysis is crucial in software and database research, providing authors with valuable insights, important applications, and significant contributions.[15] Authors utilize it to gain a comprehensive understanding of the existing body of knowledge in their respective domains. By analyzing citation patterns, publication trends, and co-authorship networks, key authors, influential papers and emerging study directions could be identified.[16] This analysis enables them to identify gaps in the literature, help easily detect areas requiring further development, and identify potential collaborators that contribute to the advancement of software and database fields.[17]

Furthermore, bibliometric analysis allows to assess the impact and visibility of their work and others by examining citation counts and publication metrics.[18] It provides a quantitative measure of scholarly impact, aiding in evaluating authors, institutions, and funding agencies. Overall, bibliometric analysis is a powerful tool in software and database domains, facilitating knowledge discovery, fostering collaborations, and contributing to the growth and progress of the field.[19]

The search query utilized various terms, including: "covid-19" OR "sars-cov-2" AND "health policy." The present inquiry was executed on the title, abstract, and keyword sections of Scopus, and the topic field of Web of Science (WoS), encompassing the title, abstract, author keywords, and keywords plus R. The dataset was obtained on 24 June 2023 using the specified search criteria. Pre-processing of the dataset involved loading 335 papers, of which 99 (29.60%) were omitted based on their document type, resulting in 236 papers remaining. Of these, 75 were sourced from WoS, and 161 came from Scopus. A total of 69 duplicated papers were found, all removed from the Scopus dataset. However, 43 papers were identified as duplicates with different citation numbers. After handling duplicates, the dataset contained 167 unique papers, 75 from WoS and 92 from Scopus. This comprehensive pre-processing aimed to ensure data quality and resulted in a refined dataset ready for further analysis and examination. This investigation focused on addressing the following research questions to highlight key aspects related to post-COVID-19 and health policy:

1. How many publications have been published on post-COVID-19 and health policy, and how has the study evolved?
2. Which countries have made significant advancements in investigating post-COVID-19 and health policy?
3. What are the main areas of research and recurring themes found in the literature exploring post-COVID-19 and health policy?
4. Which papers have the highest citation count and are considered primary and influential post-COVID-19 and health policy?

Results

The bibliometric analysis presented two sections with descriptive information on publication growth, countries involved, study areas, and highly cited papers. Additional foci were the evolving keywords used, inspiring future studies and lessons in post-COVID-19 and health policy.

Publication Growth and Pattern-Related Studies on Post-COVID-19 and Health Policy

Figure 1 depicts the analysis of publication growth and patterns in post-COVID-19 and health policy. The figure illustrates the trends observed in publications from 2019 to 2025 using Scopus and WoS databases. It shows each database's total number of publications, the annual growth rate (AGR), and the average daily yield (ADY).

The negative AGR (-4 for Scopus and -2.5 for WoS) indicated decreased publications over time. The ADY remained constant at 0, suggesting a consistent publication rate. The h-index, a measure of productivity and impact, was 13 for Scopus and 14 for WoS, indicating the presence of highly cited publications. The figure also provides year-wise publication counts, revealing variations in output. These findings highlighted the dynamic nature of post-COVID-19 and health policy literature and emphasized further investigating the factors influencing these trends.

Top Countries in Post-COVID-19 and Health Policy-Related Papers

Figure 2 showcases the leading countries in post-COVID-19 and health policy studies. The United States has the highest contribution with 62 publications, followed by the United Kingdom with 25, Canada with 19, Australia and Italy with 13 each. These countries have consistently published papers, maintaining a stable publication rate over the years (AGR, ADY, and percentage of documents in last years (PDLY) of 0). The United States holds an h-index of 14, with highly cited publications indicating significant influence. The United Kingdom also has notable contributions, with an h-index of 11. Canada, Australia, and Italy have h-indices of seven, demonstrating their presence in research. Examining publication counts by year, the United States experienced an increase from 14 publications in 2019 to a peak of 23 in 2022, followed by a slight decline in 2023. The United Kingdom decreased from nine publications in 2020 to five in 2021, maintaining consistency thereafter. Canada witnessed a remarkable rise from one publication in 2020 to 10 in 2021, followed by a decline in 2022. Australia peaked with eight publications in 2022 and none subsequently. Italy displayed a steady output, ranging from three publications in 2020 and 2021 to five in 2022.

Key Areas of Literature Exploring Post-COVID-19 and Health Policy

Figure 3 presents key areas of literature on post-COVID-19 and health policy. In Health Care Sciences & Services, the highest number of publications (10) showed a slight decline in output (-0.5 AGR), consistent rate (2.5 ADY), and significant presence (h-index 6). In Public Administration, five publications had similar trends.

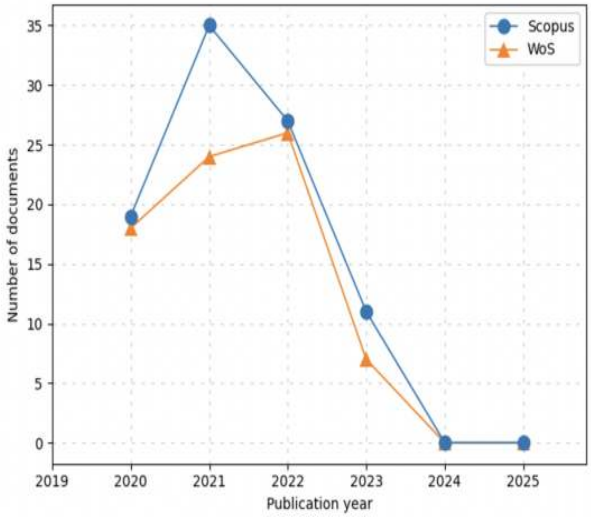

Figure 1. Publication Growth and Pattern-Related Studies on Post-COVID-19 and Health Policy

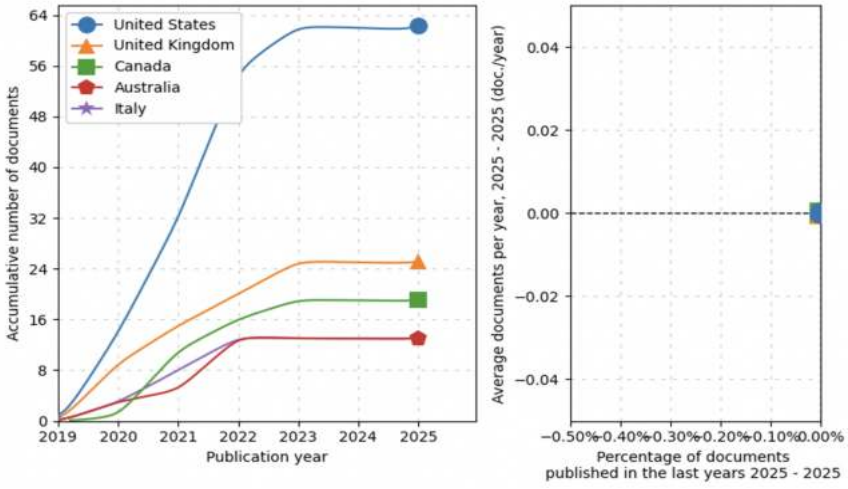

Figure 2. Top Countries in Post-COVID-19 and Health Policy-Related Papers

Other subject areas like Social Work, Computer Science, Education & Educational Research, Geology, and Geriatrics & Gerontology had varying publication counts and statistics.

Top Author Keywords with Recurring Themes Associated Literature on Post-COVID-19 and Health Policy

Figure 4 represents the top author keywords, showing the most recurring themes associated with literature on post-COVID-19 and health policy. The keyword "COVID-19 Pandemic" is most prominent with nine publications. Additionally, the positive AGR of 2 indicated an increasing trend in research output over time, reflecting the urgency and significance of studying the pandemic and its impact on health policy. The ADY of 3 suggested a consistent publication rate in this area. Furthermore, the high h-index of 2 indicated the presence of influential publications in this field. Finally, the increasing number of publications from 2020 to 2023 underscored the ongoing attention and study dedicated to understanding and addressing the pandemic's challenges and implications for health policies.

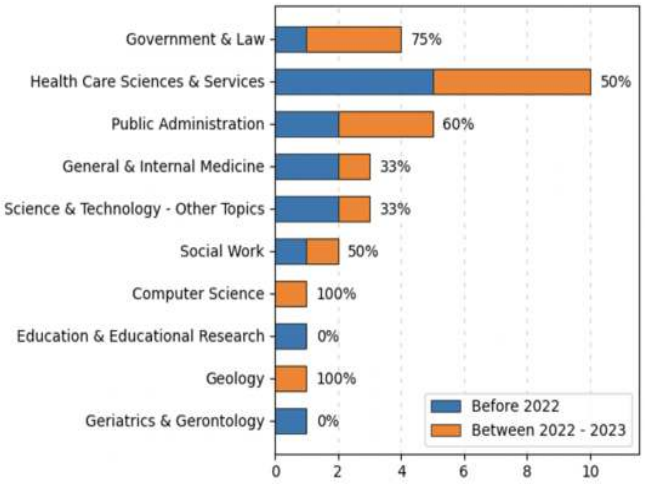

Figure 3. Key Areas of Literature Exploring Post-COVID-19 and Health Policy

"Public health policy" was another significant keyword associated with five publications. Although the negative AGR of -0.5 indicated a slight decline in study output, the subject remains a critical study area. The consistent ADY of 1.5 reflected a steady publication rate, and the h-index of 2 suggested a moderate impact. Conversely, while the number of publications increased from one in 2020 to three in 2022, the decline to zero in 2023 might indicate a shift in research focus or the need for further investigation in this area.

"Epidemiology" and "Pandemics" each have three publications. "Epidemiology" demonstrates a positive AGR of 1, reflecting increased research interest. The ADY of 1 suggested a consistent publication rate, and the moderate h-index of 1 impacted the field. However, "Pandemics" showed a stable AGR of 0 and a lower ADY of 0.5. While the number of publications was lower, an h-index of 2 suggested some influential contributions in this area. These keywords highlighted the importance of studying disease transmission patterns, risk factors, and outbreak management strategies, particularly in the context of the ongoing COVID-19 pandemic.

"Surveillance," "coronavirus," "health disparities," "Data envelopment analysis," "Ecological study," and "Europe" each had two associated publications. "Surveillance" had an ADY of 0, indicating a lower publication rate, but the higher h-index of 3 suggested a notable impact within this field. In contrast, "coronavirus" and "Ecological study" both demonstrated an ADY of

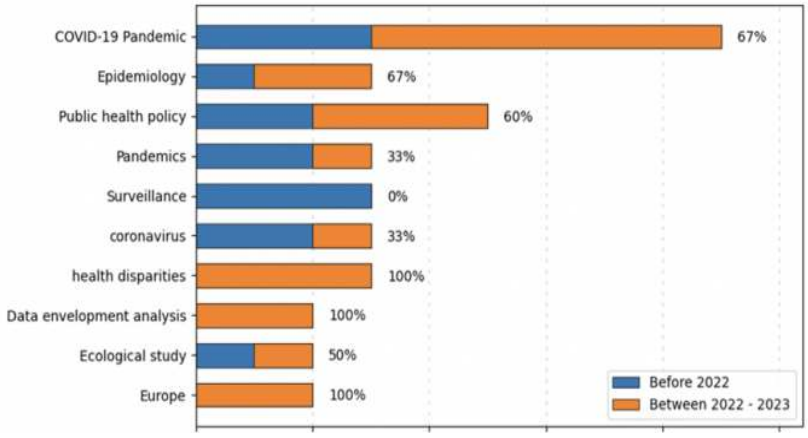

Figure 4. Top Author Keywords with Recurring Themes Associated Literature on Post-COVID-19 and Health Policy

0.5, indicating a relatively steady publication rate. While "coronavirus" had a higher h-index of 3, "Ecological study" had an h-index of 1. "Health disparities" reflected a specific focus on understanding and addressing inequities in health outcomes, and its higher PDLY of 100 might indicate challenges in publishing studies in this area. "Data envelopment analysis" and "Europe" exhibited similar PDLY values of 100 but had different h-indices of 2 and 1, respectively, suggesting varying levels of impact in their respective fields.

Highest Citation Count in the Field of Post-COVID-19 and Health Policy Minimal 50 Citations

The publication "Trust and Compliance to Public Health Policies in Times of COVID-19" by Bargain and Aminjonov received the most citations (306) among studies related to COVID-19 and health policy.[20] This indicated the significant impact of their work in understanding the role of trust and compliance in public health policies during the pandemic. In comparison, the publication "COVID-19 Pandemic and Comparative Health Policy Learning in Iran" by Raoofi, *et al.*, received 122 citations, illuminating lessons learned from comparative health policy in Iran during the pandemic.[21]

Also notable is a review by Prado, *et al.*, with 103 citations.[22] They explore wastewater-based epidemiology as a tool for tracking SARS-CoV-2 and supporting public health policies at Brazil's municipal level, highlighting its potential in monitoring the virus's spread.[22] Additionally, the publication "COVID-19 Evolution During the Pandemic – Implications of New SARS-CoV-2 Variants on Disease Control and Public Health Policies" by van Oosterhout, *et al.*, received 102 citations.[23] Their review addresses the implications of emerging SARS-CoV-2 variants in disease control and public health policies, emphasizing the need for adaptive measures.[23]

The publication "Health Policy and Leadership Models During the COVID-19 Pandemic: A Review" by Nicola, *et al.*, garnered 76 citations.[24] Their review examines various health policy and leadership models implemented during the pandemic, contributing to a better understanding of effective strategies for managing public health crises. Lastly, the review "Smoking, SARS-CoV-2 and COVID-19: A Review of Reviews Considering Implications for Public Health Policy and Practice" by Grundy, *et al.*, received 70 citations.[25] Their work critically assesses the implications of smoking in the context of SARS-CoV-2 and COVID-19, providing insights into its impact on public health policies and practices.[25]

Discussion

Data analysis from Scopus and WoS databases shows decreased publications over time, with negative AGR but constant ADY. Despite the observed decline in publication growth for studies on post-COVID-19 and health policy, there is still consistent output of publications with highly cited works that stress the significance of study in this area. Further examination is necessary to comprehend the factors impacting publication trends.

For several reasons, the United States has emerged as a leading contributor to post-COVID-19 and health policy literature. The country boasts a robust research infrastructure with numerous universities, research institutions, and funding opportunities, enabling extensive studies and a larger number of published papers. Additionally, the United States possesses numerous experts and resources dedicated to this field, facilitating high-quality publications and significant contributions to the literature. Adequate funding is crucial in supporting study in this area, allowing authors to undertake comprehensive studies and disseminate their findings. Furthermore, the United States actively engages in international collaborations, leading to increased joint publications and further strengthening its position in the field. The country's research culture places great importance on post-COVID-19 and health policy study, fostering an environment encouraging authors to publish their findings.

Two prominent areas that have received significant attention in the literature are Government & Law and Health Care Sciences & Services. The focus on Government & Law highlights the critical role of government actions and legal frameworks in addressing public health crises like the COVID-19 pandemic. This area examines the implications of government policies, regulations, and legal frameworks in managing the pandemic and its impact on public health. It provides valuable insights into the effectiveness and impact of governmental responses, aiming to inform future policymaking and crisis management strategies.

Key themes in post-COVID-19 and health policy study included "COVID-19 Pandemic," "Public health policy," and "Epidemiology." The authors were delving deeper into understanding the pandemic's long-term effects on healthcare systems, including the resilience of health infrastructure, healthcare delivery models, and capacity to respond to future public health crises. As the pandemic evolves and health policies continue to be implemented, there is an opportunity to explore the effectiveness of different policy approaches, analyze their outcomes, and identify best practices for managing similar health emergencies in the future.

Epidemiology is a growing study interest focusing on refining disease transmission models, identifying risk factors, and developing effective outbreak management strategies. This involves studying the impact of various public health interventions, testing strategies, contact tracing methodologies, and vaccination campaigns. Furthermore, study in the field emphasizes "Public health

policy." It recognizes "health disparities" as an important keyword, indicating a need to address the unequal impact of the pandemic on different population groups. This could involve examining social determinants of health, assessing intervention effectiveness in reducing disparities, and proposing policies that promote health equity.

Notable works have focused on the crucial aspects of the pandemic, including the role of trust in shaping effective policy responses and valuable lessons learned from comparative health policy experiences in different contexts. These contributions highlight the significance of comprehending trust, compliance, and cross-country knowledge exchange in developing effective health policies in the post-COVID-19 era.

Conclusion

This study uses bibliometric analysis to examine post-pandemic health policy study. It identifies publication trends, countries involved, study areas, and highly cited papers. Publications in this field showed a declining growth rate, necessitating further investigation into the factors behind this trend. The United States contributes most to post-pandemic health policy literature, followed by the United Kingdom, Canada, Australia, and Italy. Key study areas included healthcare services, public administration, and interdisciplinary subjects, reflecting the field's dynamic nature. Important themes like the COVID-19 pandemic, public health policy, epidemiology, and health disparities emerged consistently. This study provides valuable insights for future study and informs evidence-based post-pandemic health policies by analyzing the study landscape and identifying gaps.

Abbreviations

COVID-19: coronavirus disease 2019; WoS: Web of Science; AGR: Annual Growth Rate; ADY: Average Daily Yield; PDLY: Percentage of Documents in Last Years.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Scopus and Web of Science (CSV files), and ScientoPy were used as study materials.

Authors' Contribution

AA and KHA conceptualized the study design, contributed to data analysis, interpreted the results, drafted the manuscript, and approved the final copy. SRR, NSR, and NT helped prepare the manuscript. All authors read and approved the final version of the manuscript.

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Indonesia's COVID-19 Trend After the End of a Public Health Emergency of International Concern: Preparation for an Endemic

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Abstract

Three years into the pandemic, the World Health Organization revoked the COVID-19 public health emergency of international concern on 5 May 2023. This decision sparked debate, notably around the possibility of a surge in cases due to the SARS-CoV-2 mutations. To manage this transition, the Indonesian government enacted stringent controls on case numbers. This case series study provided an overview of COVID-19 case trends in Indonesia following the revocation of public health emergency of international concern status by the World Health Organization. Data were collected for 5 weeks after the statement (6 May-10 June 2023) from the COVID-19 Task Force's official online platform of the Indonesian Ministry of Health. The trends were monitored in daily confirmed, active, recovered, and death cases, and analyzed the data using Microsoft Excel and Stata 16. The findings indicated a positive trend for Indonesia, with decreased daily confirmed cases (89.42%) and active cases (44.16%). Recovered cases accounted for 97.47%, higher than the global average (96%). Unfortunately, the death rate (2.38%) exceeded the global statistic (1%). These results highlighted the need for sustained vigilance, enhancement of the 3T strategy (testing, tracing, and treatment), and wider vaccination coverage. It remains critical to uphold the 3M protocols—mask-wearing, physical distancing, and hand hygiene—to prevent a potential rebound in cases, even without the public health emergency of international concern status, as the situation transitions toward endemic COVID-19.

Keywords: COVID-19, endemic, Indonesia, pandemic, public health emergency of international concern

Introduction

Since early 2020, the coronavirus disease 2019 (COVID-19) pandemic has led to various global changes. Within the first two weeks of onset, cases increased 13-fold in the disease's origin country, China, and later spread to 114 countries.[1] This prompted the World Health Organization (WHO) to declare a Public Health Emergency of International Concern (PHEIC) on 30 January, 2020,[2] and to subsequently establish a pandemic status on 11 March 2020.[3]

The PHEIC status is the highest alert issued by the International Health Regulations (IHR),[4] a cooperative network of 196 countries that significantly detect and report potential global public health emergencies.[5] It represents an extraordinary event, whether unusual or unexpected, that poses a public health risk to other nations due to the international spread of disease, necessitating a coordinated international response.[6] This status also empowers the WHO Director-General to declare a "temporary recommendation," which requires both affected and unaffected countries to be actively involved in preventing and reducing the spread of disease through restrictions on international travel and trade.[6]

In contrast to PHEIC, pandemic status only denotes the geographic extent of a new disease and does not entail the international legal consequences associated with a "temporary recommendation."[7] The Centers for Disease Control and Prevention (CDC) defines a pandemic as an epidemic that spreads across several countries or continents, causing widespread infection.[8] An epidemic, conversely, is a sudden surge in disease incidence above the normal level within a specific population or area.[8]

Three years into the pandemic, the WHO Director-General officially revoked the COVID-19 PHEIC status during the 15th IHR (2005) Emergency Committee meeting on 4 May 2023, based on the global decreasing trend in COVID-19 cases.[9] Moreover, due to scientific advancements in disease diagnosis and management, COVID-19 is no longer considered to meet extraordinary or unexpected criteria.[9]

In Indonesia, the term "pandemic" is more commonly used to describe the COVID-19 outbreak than "PHEIC."

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As of 29 April 2023, based on data from the Indonesian Ministry of Health, there were 6,773,146 confirmed cases and 161,272 deaths (2.38%) due to COVID-19.[10] Compared to global statistics, Indonesia's COVID-19 mortality rate was relatively high. Globally, out of the recorded 764,474,387 COVID-19 cases, there were 6,915,286 deaths, representing about 0.90% of total cases.[10]

In response to the pandemic, the Indonesian government established a special task force for managing COVID-19, introduced various programs to limit social interaction, and initiated a COVID-19 vaccination campaign.[8] These initiatives aim to prevent the transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) through droplets and promote herd immunity through humoral immune responses.[11] Despite these efforts, Indonesia has faced numerous challenges in combating the COVID-19 infection.

The unpreparedness of facilities and infrastructure for handling cases, coupled with inadequate public awareness about preventing transmission, has resulted in a high number of confirmed cases and a significant mortality rate. Steps to improve health services, hospitals, laboratories, and related infrastructure are necessary, along with educating the public through various media and ensuring cross-sector coordination. These actions are expected to control the outbreak without exacerbating economic losses.[8]

The COVID-19 cases in Indonesia experienced two sharp increases: one from June to September 2021 due to the Delta variant (the second wave) and another in February 2022 due to the Omicron variant (the third wave).[8] The highest death toll occurred in December 2020 (the first wave) and June–July 2021 (the second wave).[11] The potential for virus mutations leading to new variants presents a risk for future waves. Each variant's distinct characteristics, clinical manifestations, and severity must be considered to understand the epidemiology of COVID-19.

At the beginning of 2023, COVID-19 cases in Indonesia began to show a positive trend. The percentage of active cases was lower than global figures (0.27% compared to 3.01%).[12] The recovery rate reached 97.35%, 1.35% higher than the global recovery rate (96%).[12] Unfortunately, confirmed cases in Indonesia on 7 May 2023 were double the number of cases reported on 7 April 2023, and the mortality rate exceeded the global rate.[12]

Recently, governments worldwide have begun preparing for a transitional phase toward long-term COVID-19 management.[9] The hope is that there will be no rebound in cases or the emergence of new variants that could reverse the positive trend observed since the beginning of 2023. Consequently, it is imperative to review the trend of COVID-19 cases in Indonesia following the revocation of PHEIC status by the WHO. Thus, this case series study aimed to provide an overview of the trends in COVID-19 cases in Indonesia after this significant status change.

Method

This case series study employed a quantitative descriptive method. Data were obtained from the Indonesian COVID-19 Task Force's online platform (covid19.go.id) of the Indonesian Ministry of Health; this platform, updated daily, offers open access to its data.[13] The data collection period spanned five weeks following the revocation of PHEIC by the WHO, specifically from 6 May to 10 June 2023. The data were then processed using Microsoft Excel Version 2208 and Stata 16. The results were presented descriptively, highlighting the number of active, confirmed, recovered, and death cases. Graphs have been employed to illustrate the trend of COVID-19 in Indonesia from 5 May (when the WHO ended the PHEIC status) until 10 June 2023.

Results

Table 1 indicates that the number of confirmed cases before the observation period (5 May 2023) was 6,784,170. After the observation period (10 June 2023), this had risen to 6,810,008 cases, an increase of 25,838 cases (0.38% of the total confirmed cases in Indonesia). By utilizing pandemic indicators to compare the increase in confirmed cases over the past month, the data reveals a decrease of 89.42% from 10 May to 10 June 2023.

The number of active cases also decreased before and after the observation period. The decrease was 41.14%, from 17,909 active cases at the start of the observation period to 10,541 at the end. This data closely align with the pandemic indicators. Comparing the increase in active cases over the last month, from 10 May to 10 June 2023, there was a decrease of 44.16% in active cases.

At the beginning of the observation period, the number of recovered cases was 6,604,857, which rose by 32,790 cases during the observation period (an increase of 0.50%). At the end of the observation period, the percentage of recovered cases stood at 97.47% of the total confirmed cases in Indonesia. As for death cases, there was an increase of 0.26% during the observation period. The increase was by 416 cases, while 161,404 deaths had been recorded since the beginning of the pandemic. Compared to the number of confirmed cases, deaths related to COVID-19 in Indonesia reached 2.38% at the end of the observation period.

The average number of daily active cases was 14,664, with a standard deviation of 2847.925 (Table 2). The peak in total active cases occurred on 11 May 2023, reaching 19,067 cases, while the lowest was recorded on the last day of the observation period, 10 June 2023, with

10,541 cases. Daily confirmed cases varied from 178 (9 May 2023) to 1,902 (2 June 2023). The average number of daily confirmed cases was 717.72, with a standard deviation of 512.55. At the end of the observation period, there were additional 187 confirmed cases. Recovered cases documented during the observation period ranged from 243 to 2,242 cases, with an average of 910.83 and a standard deviation of 490.08. The lowest number of recovered cases was reported on the last day of observation, while the highest number was noted on 15 May 2023.

The lowest number of daily death cases also occurred on the last day of the observation period, with no death cases reported on 10 June 2023. The highest number of

Table 1. Overview of the COVID-19 Trend in Indonesia

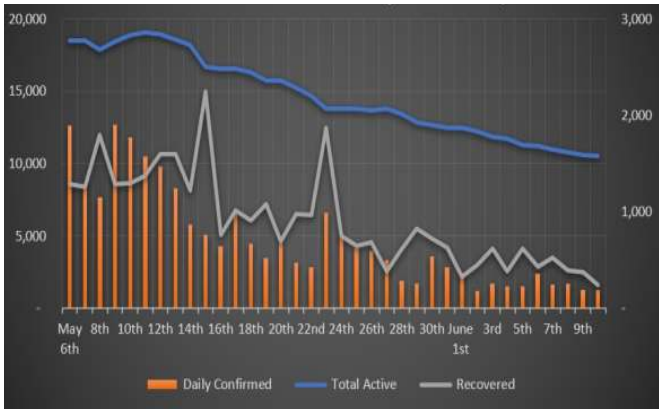
Variable	Category	Amount (Cases)	Fluctuation (%)
Confirmed cases	10 May 2023	1,768	
	10 June 2023	187	-89.42
	Before the observation period[14]	6,784,170	
	End of the observation period	6,810,008	
	During the observation period	25,838	0.38
Active cases	10 May 2023	18,877	
	10 June 2023	10,541	-44.16
	Before the observation period[14]	17,909	
	End of the observation period	10,541	-41.14
Recovered cases	Before the observation period[14]	6,604,857	
	During the observation period	32,790	0.50
	End of the observation period	6,637,647	97.47
Death cases	Before the observation period[14]	161,404	
	During the observation period	416	0.26
	End of the observation period	161,820	2.38

Notes: The observation period was from 6 May to 10 June 2023; A negative sign indicates a decrease in cases and vice versa.

Table 2. Descriptive Analysis of COVID-19 Trends in Indonesia After PHEIC Status Revocation (6 May–10 June 2023)

Variable (n = 36)	Mean	Minimum	Maximum	Range	SD
Total active cases	14,664.14	10,541	19,067	8,526	2,847.925
Confirmed cases per day	717.72	178	1,902	1,724	512.55
Recovered cases per day	910.83	243	2,242	1,999	490.08
Death cases per day	11.55	0	35	35	8.41

Notes: SD = Standard Deviation; The data are presented as the number of cases.



Note: Daily Confirmed and Recovered Cases in secondary axis

Figure 1. COVID-19 Cases in Indonesia from 6 May to 10 June 2023

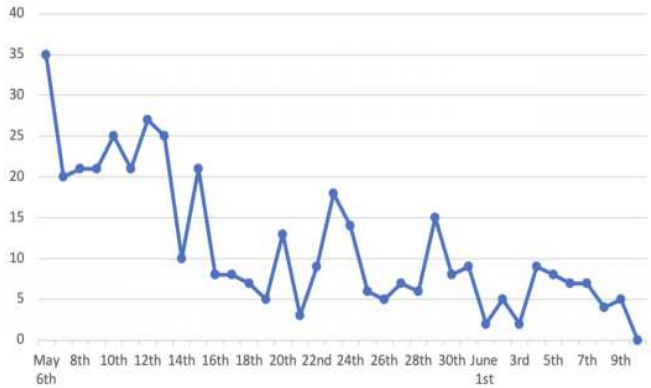


Figure 2. Number of Daily COVID-19 Death Cases in Indonesia from 6 May to 10 June 2023

deaths occurred on 6 May 2023, the first day of observation, with 35 deaths recorded in a single day. In the interim, the number fluctuated, with an average of 11.55 cases and a standard deviation of 8.41. The data obtained during the observation period are presented using bar and line charts in Figures 1 and 2. These illustrate decreased active cases, total confirmed, recovered and death cases. However, there were fluctuations indicated by several spikes, with decreasing trends documented as the graphics flattened over time.

Discussion

The WHO's decision to revoke COVID-19 PHEIC status has elicited a variety of responses, both in favor and against.[15] The IHR noted a downward trend in COVID-19 deaths, a decrease in intensive care unit admissions, and high levels of population immunity to SARS-CoV-2, suggesting that it is time to transition to long-term management of the COVID-19 pandemic while acknowledging the possibility of viral evolution.[15,16] The press conference in Geneva emphasized that this does not mean that COVID-19 is no longer a global threat.[16] All countries must not interpret this as a reason to lower their guard, neglect the health regulation system built over three years, or convey the wrong message to the population that COVID-19 is no longer a cause for concern.[15]

The emergence of new variants and decreasing vigilance could potentially lead to a new pandemic. The WHO's decision might result in difficulties accessing vaccines, laboratory kits, and health statistics data related to COVID-19. A week after the declaration, the US public health emergency ended, and the CDC officially announced the termination of the free rapid test policy.[15] The policy mandating data collection has been withdrawn, implying that health laboratories are no longer required to report testing results, nor is each state required to share real-time COVID-19 statistics. On the other hand, maintaining PHEIC status for an extended period could undermine community trust in the WHO and public health agencies. In the future, when a public health emergency declaration is needed, gaining public support and attention could prove challenging.[15]

The Indonesian government has begun to formulate a transition from the COVID-19 pandemic to an endemic state, which was announced at the end of June 2023. In this endemic state, COVID-19 is expected to follow a pattern similar to influenza and other viral acute respiratory infections (ARIs), with mild or asymptomatic symptoms. This state could be achieved if herd immunity is established through vaccination or infection recovery. Hanifah and Siregar predicted that during the transition period, COVID-19 would begin to be treated as endemic, with persistently low numbers of cases in areas with high vaccination coverage.[8] While, the vaccination target should be met in areas with low vaccination coverage before transitioning.[8]

The Indonesian Minister of Health has emphasized four considerations during this transition period: understanding COVID-19 and how to avoid it, surveillance and detection, antiviral drugs, and the COVID-19 vaccine.[17] The government also continues monitoring daily case data, including the number of recovered and confirmed cases, deaths, active cases, vaccination rates, and other data related to the pandemic transition.[17] Figure 1 shows that the additional daily confirmed cases in Indonesia have decreased. Table 1 shows an approximately 89.42% decrease in cases from 10 May to 10 June 2023. The decrease reached 93% on 11 June 2023, with 111 cases compared to the 1,577 cases recorded on 11 May 2023.[14]

According to the 2022 COVID-19 Management Guidelines, 4th Edition, a "confirmed case" is defined as a person who meets one of the following criteria: (a) a person with positive Nucleic Acid Amplification Test (NAAT) results; (b) a person who meets the criteria for suspected or close contact cases and has positive Antigen Rapid Diagnostic Test (Ag-RDT) results in regions B and C as per the Ag-RDT usage criteria; (c) a person with a positive Ag-RDT test result in line with the usage guidelines for Ag-RDT in region C.[18] NAAT is a nucleic acid amplification examination method for detecting and identifying the genetic material of pathogenic organisms, one variant of which is known as Polymerase Chain Reaction (PCR).[19] Regional criteria for testing are determined based on the availability and accessibility of diagnostic tools as well as the length of the waiting time for test results.[19] Region A areas have the closest access and shortest waiting time for COVID-19 diagnostic tools.[18,19]

The number of documented confirmed cases correlates with the number of specimens taken and the public's awareness of getting tested when exhibiting symptoms suggestive of COVID-19. Over time, it is undeniable that public awareness of disease detection and protection measures has begun to decline. One of the contributing factors to this is a decrease in disease severity along with the mutation of the SARS-CoV-2 variant. An in vitro study by the University of Hong Kong stated that the Omicron variant can replicate 70-fold faster in airway cells than the Delta variant.[18] However, the Omicron variant replicates 10 times slower in lung parenchyma cells, suggesting that while Omicron is more transmissible and mutable, its severity is lower than its predecessor.[18]

According to the COVID-19 Task Force Weekly Report dated 11 June 2023, the number of individuals tested in the second week of June 2023 was approximate-

ly 27.99%, including 12,791 individuals tested with PCR (16.93%) and 62,769 with antigen tests (83.07%). This weekly testing rate was below the WHO target of 100%. There is a need to enhance testing as the primary standard for COVID-19 diagnosis. Especially in conditions of low case numbers, it is crucial to maintain a high number of tests to detect any escalation in transmission, thereby enabling early intervention before a significant spike occurs.[19]

Active cases refer to patients still undergoing treatment, whether in health facilities or self-isolation.[18] This condition can conclude in two ways: recovery, denoted by the number of recovered cases, or death, indicated by the number of death cases.[18] As illustrated in Figure 2, the number of active cases in Indonesia seems to have plateaued. Data comparison between 11 May 2023 and 11 June 2023 reveals a decrease in cases by 45%, from 19,067 to 10,483. The number of active cases in Indonesia is also below the global average of active cases (3%), with a difference of -2.85% equating to 0.15%.[13] Control of active cases has been achieved by implementing 3M health protocols (*menggunakan masker*/mask-wearing, *menjaga jarak*/physical distancing, and *mencuci tangan dengan sabun*/washing hands with soap), accelerating vaccination efforts, and strengthening 3T (testing, tracing, and treatment) strategies.[13]

The criteria for COVID-19 recovery are determined based on disease severity. Patients without symptoms are considered to have recovered after ten days of isolation. For those with mild or moderate symptoms, recovery is defined as completing isolation (10 days from the confirmation date plus at least three additional days free of fever symptoms and respiratory problems).[18] No follow-up Reverse Transcription Polymerase Chain Reaction (RT-PCR) examination is needed unless comorbidities or potentially worsening conditions are present. Patients with severe or critical symptoms require one RT-PCR-negative examination after a minimum of 3 days without symptoms.[18] In cases where RT-PCR is difficult to access, the criteria for recovery include complete isolation for ten days from symptom onset plus at least three additional days without symptoms of fever or respiratory problems.[18]

The recovery trend in Indonesia is promising. The number of recovered cases reached 97.47% of the total cases, surpassing the global recovery rate by 1.47%, with the world's recovery rate at approximately 96%.[13] The five provinces with the highest recovery rates are the Special Capital Region of Jakarta, West Java, Central Java, East Java, and Banten, collectively contributing to 66.17% of the national recovery rate.[13]

Conversely, the mortality rate related to COVID-19 in Indonesia is higher by 1.38% (2.38%) compared to the global statistics (1%). Central Java, East Java, West Java, the Special Capital Region of Jakarta, and the Special Region of Yogyakarta are the five provinces with the highest mortality rates, contributing to 65.01% of the national mortality rate.[13] During the pandemic, the WHO recorded nearly 7 million deaths due to COVID-19. A previous study suggested that the actual mortality rate could be about three times higher than that.[15] Additionally, many COVID-19 patients still require intensive care, and survivors often experience post-infection effects.[18] This situation presents further challenges for the Indonesian government as it prepares for the transition to COVID-19 becoming endemic after the WHO revoked PHEIC status in early May 2023.

Conclusion

From observing the 5 weeks following the WHO's revocation of PHEIC status (6 May–10 June 2023), it can be concluded that COVID-19 cases in Indonesia have shown a positive trend. The last day of observation data reveals a decrease in daily confirmed cases of 89.42% compared to a month earlier. Active cases decreased by 44.16% compared to a month earlier and are 2.85% below global statistics (0.15% versus 3%). While the recovery rate in Indonesia is 1.47% higher than the world's recovery rate (97.47% versus 96%), COVID-19-related deaths are still 1.38% higher than global deaths (2.38% versus 1.00%). Although the statistical graph appears to have plateaued, the strengthening of 3T, increasing vaccination coverage, and implementing 3M are still required for Indonesia to successfully navigate the pandemic transition period toward long-term disease handling in COVID-19's endemic conditions.

Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; PHEIC: Public Health Emergency of International Concern; IHR: International Health Regulator; CDC: Centers for Disease Control and Prevention; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; ARI: Acute Respiratory Infection; NAAT: Nucleic Acid Amplification Test; RDT-Ag: Rapid Diagnostic Test Antigen; PCR: Polymerase Chain Reaction.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and materials are available publicly in the mass media quoted in this study.

Authors' Contribution

NN conceptualized, drafted, and provided data for this article. RM provided valuable input and insight in writing the article. H revised the manuscript and provided final approval of the version to be published.

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The Role of Resilience in Quality of Life in a Productive-Age Population During the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic has impacted various sectors and may trigger a decrease in quality of life (QoL), so resilience is urgently needed. This study aimed to analyze the role of resilience in the QoL of individuals during the second wave of the COVID-19 pandemic in East Jakarta, Indonesia. An explanatory sequential mixed methods study was conducted with a cross-sectional design. The QoL was measured using the Indonesian-HRQoL on 300 respondents through multistage cluster sampling. The explanatory qualitative approach involved Focus Group Discussions and in-depth interviews. A Cox regression was used to analyze the quantitative data. The proportion of poor QoL was 26.30%. Poor resilience (individual, family, and community) contributed to poor QoL during the pandemic. Realistic perceptions determined the role of individual resilience in QoL concerning gratitude, sincerity, patience, mutual reinforcement, accepting circumstances, implementing health protocols, cognitive emotion regulation, adaptability, and optimism. The age of family decision-makers, social support, and self-control determined the role of individual resilience in QoL. The role of community resilience in mental-emotional disorders and QoL was determined by the stability of the education system, health system, political/government system, and pandemic management system.

Keywords: COVID-19, pandemic, quality of life, resilience

Introduction

The latest pandemic that has spread to 223 countries from December 2019 until now is coronavirus disease 2019 (COVID-19).[1] There were more than 6.4 million confirmed cases of COVID-19 in Indonesia as of 8 October 2022, with an increase in daily cases of more than 1.3 thousand people, a case fatality rate (CFR) of 3.4%, and cases of recovered patients almost reaching more than 6.2 million people.[2] In Indonesia, the Special Capital Region of Jakarta Province was the epicenter of the COVID-19 pandemic. The impact of a pandemic involves mental-emotional disorders (in the form of behavioral, emotional, cognitive, and risky behavior disorders),[3,4] declining family income,[5] and decreased quality of life (QoL).[6-10] Therefore, resilience mechanisms are needed from the individual, family, and community to resist, adapt to, and recover from the effects of disasters in a timely and efficient manner. A system is considered to have good resilience if coping abilities at the individual, family, and community levels in routines and emergencies are stable.[11] Community resilience includes government policy during the pandemic.

The East Jakarta was reported as the municipality with the highest incidence rate and a high mortality rate in June 2021 compared to others in Jakarta.[12] This municipality is more diverse in ethnicity, religion, culture, socioeconomics, and population density than others in the province. This condition was the baseline to assess resilience (individual, family, and community levels) and QoL for Jakarta residents during the COVID-19 pandemic. Therefore, a quantitative and qualitative in-depth study was needed to explain the phenomena and information regarding the role of resilience in QoL due to COVID-19 in the Jakarta area, especially in East Jakarta. This study is the only one that assesses the role of individual, family, and community resilience in QoL in the second wave of the COVID-19 pandemic at the epicenter in Indonesia. It used mixed methods and took an explanatory qualitative approach to examine the unique role of each resilience domain in depth.

Method

This study investigated the role of resilience (individuals, families, and communities) in QoL during the COVID-19 pandemic through an explanatory sequential mixed-methods design with a cross-sectional study. Data

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collection was carried out from July to November 2021. First, a quantitative study was conducted in the East Jakarta municipality during the peak of the second wave of the COVID-19 pandemic. Multistage cluster sampling was used to select 300 respondents who lived in East Jakarta from the beginning of the pandemic. The inclusion criteria were: lived in the village since before March 2020, aged 18 to 60 years, willing to be interviewed online, had cell phones for interviews, and could communicate well. The QoL was measured using the Indonesian Health-Related Quality of Life (INA-HRQOL),[13] the Connor-Davidson Resilience Scale (CD-RISC) for individual resilience,[14] the Family Resilience Assessment Scale (FRAS) for family resilience,[15] and the ARC-D toolkit,[16] for community resilience, which was modified for pandemic conditions. The data were analyzed using the Cox regression. Second, six Focus Group Discussion (FGD) groups (5–10 persons in each group) and nine in-depth interviews were conducted for qualitative data collection.

Result

The Role of Individual Resilience in QoL

Poor individual resilience was a risk of poor QoL during the COVID-19 pandemic (PR = 1.607; 95% CI = 0.908–2.845) after controlling for social support. So, people with poor individual resilience were 1.607 times more likely to experience poor quality of life than people with good individual resilience (Table 1).

The results were explained based on FGDs and in-depth interviews with respondents, revealing that people tended to focus on matters related to their mental state, which was the domain of cognitive emotion regulation. The respondents' adaptations involved increasing adaptability, optimism, and discipline in cognitive emotion regulation, as well as seeking reliable information related to the COVID-19 pandemic and complying with health protocols.

> *"[By being] grateful, sincere, that's one of them."* (RD, primary education, FGD)

> *"Maybe for adaptations that can make us resilient, like, for example, we take vitamins, or wearing a mask when we go out and maintaining health protocols like washing hands and bringing hand sanitizer."* (ZR, higher education, FGD)

The Role of Family Resilience in QoL

Poor family resilience was a risk of poor QoL (PR = 1.870; 95% CI = 1.016–3.442) after controlling for confounding factors (family income, job loss, history of chronic disease, and social support). People with poor family resilience tended to be 1.870 times more likely to experience poor QoL than people with good family resilience (Table 2).

This result was in line with information obtained from the community through FGDs and from stakeholders during in-depth interviews, which revealed that the internal role of the family members in forming a resilient family dramatically affected the QoL of each family member during the COVID-19 pandemic. Most FGD participants from various groups stated that social support from the nuclear and extended families greatly determines the formation of family resilience.

Table 1. Role of Individual Resilience in Community Quality of Life

Variable	PR	SE	Z	p-value	95% CI	
					Lower	Upper
Individual resilience	1.607	0.468	1.63	0.103	0.908	2.845
Social support	1.032	0.023	1.44	0.151	0.988	1.079

Notes: PR = Prevalence Ratio, SE = Standard Error, CI = Confidence Interval

Table 2. Role of Family Resilience in Community Quality of Life

Variable	PR	SE	Z	p-value	95% CI	
					Lower	Upper
Family resilience	1.870	0.582	2.01	0.044	1.016	3.442
Family income	1.075	0.295	0.26	0.791	0.627	1.842
Job loss	1.023	0.267	0.09	0.930	0.613	1.706
History of chronic disease	1.178	0.290	0.67	0.504	0.727	1.909
Social Support	1.047	0.026	1.86	0.063	0.997	1.100

Notes: PR = Prevalence Ratio, SE = Standard Error, CI = Confidence Interval

Table 3. Role of Community Resilience in Quality of Life

Variable	PR	SE	Z	p-value	95% CI	
					Lower	Upper
Community resilience	1.601	0.474	1.59	0.112	0.896	2.862
Social support	1.035	0.024	1.51	0.132	0.989	1.082

Notes: PR = Prevalence Ratio, SE = Standard Error, CI = Confidence Interval

"In my opinion, the resilience of women in covid must be increased, ma'am, because mothers are the pillars of the family [...]" (UY, primary education, FGD)

"Family resilience is the most important thing, in my opinion, it all starts from the family, one family that supports each other, automatically we give the effect to other people too." (AI, primary education, FGD)

"[...] so the family must also be ready as well as the community, for example, if our family is ready to face this pandemic, but the community does not support it, it's just like moving alone in a negative environment." (AS, primary education, FGD).

Family resilience was inseparable from the influence of the age of the head of the family, financial insecurity, family social support, and the self-control of each family member. Most of the older participants had higher education and were in the non-COVID-19 survivor group, stating that the older a person is, the more diverse experiences they have gone through and the more emotionally mature they are. This statement made it easier to form a resilient family and have a good QoL during the pandemic, drawing on decision-making experience, analyzing risks, and solving problems. The Empowerment, Child Protection, and Population Control (ECPPC) Office mentioned programs for people under 36 years old to build emotional maturity and the QoL of children and adolescents, such as the *Generasi Berencana* (Planned Generation), the children's forums in each subdistrict, and *Program Calon Pengantin* (prospective marriage couple program).

"[…] had a lot of experience dealing with problems […] maybe during his lifetime he encountered problems like that, right?" (RH, higher education, FGD)

"[...] we actually target teenagers, Alhamdulillah, the 'Planned Generation' in East Jakarta is very well organized, then we also have a children's forum spread in every subdistrict. In our case, it means that we can enter our target, there is also prospective marriage couple program that PK2 handles [...]" (PS, ECPPC Office, interview)

The Role of Community Resilience in Quality of Life

This study found poor community resilience to be a risk for poor QoL during the COVID-19 pandemic (PR = 1.601; 95% CI = 0.896–2.862) after controlling for social support. So, people with poor community resilience tended to be 1.601 times more likely to experience poor QoL than people with good community resilience (Table 3).

Community resilience may have formed since the beginning of the pandemic. The impact of the COVID-19 pandemic caused a crisis or imbalanced situation that traumatized individuals and communities. Then, community resilience was formed, like the mechanism in post-traumatic growth (PTG). Some FGD participants in the low-education group stated that the swift government response in social assistance and loans for micro, small, and medium enterprise (MSME) actors determined their QoL. The FGD participants considered this support from the government and the environment as social support.

"From the government, maybe social assistance is needed to strengthen the resilience of the community and to facilitate loans for MSMEs [...]" (RD, primary education, FGD)

"There are many groceries and cash assistance [BST] programs from the private sector and the government. From CSR too, agency too. BST should be targeted at vulnerable groups." (RN, Social Office, interview)

"[…] the East Jakarta area is indeed the most affected, seen from several Regional Agency for Disaster Management activities, the target is the most. Like the distribution of masks and other assistance." (BR, Head of Regional Agency for Disaster Management, interview)

Qualitative study revealed information about the stabilizing roles of education, health, and government systems as components of community resilience. These systems were essential in forming community resilience and maintaining QoL during the pandemic. It was because the organization of those systems was adaptive and helped the community bounce back from the negative impact of the pandemic.

"[…] the government is good, the people will automatically follow suit. A good education will later support a good economy in the future […]" (WT, poor QoL, interview)

"[…] I am a teacher. At school, I must provide material to students by sending videos or broadcasting for formal examples, especially from the government and agencies […] I also cadre in my neighborhood. We are given counseling from the sub-district village, and then we are informed to the residents […]" (HI, higher education, FGD)

"Jakarta Province is so supportive of this pandemic. Every week there is an urban village meeting, and the sub-district is involved. Then the procedure for following up complaints is also fast, 6 hours." (RN, Social Office, interview)

Discussion

Individual Resilience

The study found that poor individual resilience was a risk for poor QoL (PR = 1.607; 95% CI = 0.908–2.845) after controlling for social support (Table 1). Interventions need to be carried out to increase the resilience of these individuals during the COVID-19 pandemic and other pandemics that may occur in the future. Based on the concept of crisis intervention, there are three balancing factors to overcome a crisis: realistic perceptions, coping mechanisms, and social support.[17] This commitment/control ability is closely related to the formation of PTG regarding a person's previous experience of overcoming problems and social support. The same goes for forming coping mechanisms, adaptability, and cognitive emotion regulation. Social support can come from the nuclear family, extended relatives, friends, neighbors, and the relevant government. This social support can be through assistance or community formation.[18] Interventions to form effective coping mechanisms and growth can also be carried out, especially during a pandemic that involves conditions such as lockdowns.[19]

This study found that adaptability, optimism, and cognitive emotion regulation affect individual resilience in QoL, which aligns with existing theory. A crisis is defined as a condition with bad consequences for individuals, and there are three balancing factors to avoid a crisis and its associated poor QoL.[16] Realistic perceptions, coping mechanisms, and social support are needed. Coping mechanisms refer to individual efforts to solve problems and adapt to new situations. Realistic perceptions are also related to cognitive emotion regulation. People can think realistically when they can regulate their negative emotions.[17] When these components are in good condition during a crisis, good QoL will be achieved.

Family Resilience

The study found that poor family resilience was a risk for poor QoL (PR = 1.870) after controlling for family income, job loss, history of chronic illness, and social support (Table 2). People perceived the family resilience component: the family belief system – as a spiritual activity. Participants admitted that they became more regular in listening to religious lectures on television and other social media and more intensive in praying with their families at home. Family organization patterns and problem-solving communication did not change before and after the COVID-19 pandemic, even when family members died. Accumulated family stress could cause family crises, including physical and emotional problems.[20] During the pandemic, parents (specifically) and families in general were experiencing turmoil in many areas of life (e.g., family, school, and economy), causing shifts in family dynamics and routines that led to mild to severe mental distress. These positive and negative changes require family resilience.[20,21]

The component of family resilience during the pandemic played an essential role in family functioning to determine family prosperity. However, families also faced threats during the pandemic, such as financial insecurity, job loss, caregiving burdens, and stress related to social restrictions (e.g., crowds, changes in structures and routines). These have a long-lasting impact on the structure and processes of the family system. However, family resilience can be shaped through shared trust and support.[22,23] If both of these are in place, the risk of families experiencing poor resilience can be prevented so that the QoL of each family member during a pandemic can be maintained or improved.

The possibility of family resilience was also determined by the condition of family relationships, such as the closeness between family members, especially between children and parents. Thus, each family member can participate in positive activities and benefit from emotional regulation support from the parents for all family members to thrive together during a pandemic.[22,23] Those whose families are not resilient may experience family relationship constraints because the impact of the pandemic is felt most heavily by parents (husband/wife), as the highest responsibility holder in the family.

Community Resilience

The study found that poor community resilience is a risk for poor QoL (PR = 1.601; 95% CI = 0.896–2.862) (Table 3). The in-depth interviews revealed that the good resilience of The Special Capital Region of Jakarta Province was due to adequate coordination. This involved external parties such as companies that can pro-

vide CSR funds and non-governmental organizations that help impacted communities economically and socially. The government had also actively involved community and neighborhood associations to encourage the community's active role in handling the COVID-19 pandemic. Reliable information and the involvement of government and community leaders increased the confidence of the majority of the community in the provincial government's policies. This policy also utilized the natural capital of the Jakarta area, an urban center and administrative cities with a small area.[24] It facilitated the supervision and regulation of the area. Factors such as natural, human, and social capital, stakeholder engagement, community action, technology and communication, and economic and financial capital from the provincial government's policies for its administrative cities were enough to maintain more than half the proportion of community resilience.

Qualitatively, the role of each component of community resilience in the occurrence of QoL was obtained. During the pandemic, community resilience primarily came from the components of the political/governmental system, the education system, and the health system. There was indeed economic instability in some families, which was the initial stimulant for poor QoL and poor resilience due to feelings of stress, pressure, and anxiety. However, BST from the provincial and village governments eased their burden. The support for families infected with COVID-19 came in the form of groceries or food. The stigma decreased after more than a year of this pandemic. The emergence of stigma was likely to occur in a sociocultural context because it forms community assumptions that contribute to shaping community growth.[18] This was why the stigma was not as severe in the second wave of the COVID-19 pandemic, compared to the first wave.

Moreover, some informants hoped that the situation would soon return to normal, while others accepted the new normal and regarded the situation with a positive perception. Certain behaviors during the pandemic, such as wearing masks, seemed to be a new habit that is difficult to let go of. The data collection for this study was carried out during an increase in cases in the second wave of the COVID-19 pandemic, which means that the respondents already had the experience of dealing with the increase in cases during the first wave. Likewise, they must have gone through the stages of shock, denial, frustration, and depression.[25,26]

A weakness of this study is that a temporal ambiguity may occurred, but qualitative methods could be used to confirm the time sequence. It was also possible that non-differential misclassification occurred, leading to underestimated results. Fortunately, the strength of this study was the use of PR as an association measure, which led the result to the true value, and there was consistency of poor resilience as a risk factor for poor QoL. The findings of the study point to the need for interventions for individual resilience, especially for commitment/control, coping mechanisms, adaptability, and cognitive emotion regulation.

Conclusion

Poor individual, family, and community resilience were found to be risks for poor QoL. The relationship between individual resilience and QoL depends on the conditions of individual resilience: cognitive emotion regulation, adaptability, and optimism. The relationship between family resilience and QoL was determined by the age of the family decision-maker, social support, and the self-control of each individual. The relationship between community resilience and QoL was primarily determined by the stability of the education system, the health system, the political/government system, and the pandemic management system.

Abbreviations

COVID-19: coronavirus disease 2019; CFR: Case Fatality Rate; QoL: Quality of Life; FGD: Focus Group Discussion; PR: Prevalence Ratio; CI: Confidence Interval; ECPPC: The Empowerment, Child Protection, and Population Control; PTG: Post-Traumatic Growth.

Ethics Approval and Consent to Participate

Ethics approval was obtained from the Health Research Ethics Commission, Faculty of Public Health Universitas Indonesia (461/UN2.F10.D11/PPM.00.02/2021) in September 2021. Written informed consent was obtained from the subjects for voluntary participation.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data are not available due to ethical restrictions. Participants in this study did not agree for their data to be shared publicly.

Authors' Contribution

FN, SR, BAK, and MKS conceptualized and designed the study. FN searched the literature, prepared the questionnaire, collected and analyzed the data, and prepared the manuscript. SR, BAK, and MKS reviewed the manuscript. All authors read and approved the final manuscript.

Authors' Contribution

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Infodemic, Health Promotion Efforts, and Preventive Behavior During the COVID-19 Pandemic in Indonesia: A Quantitative Analysis Study

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Abstract

The coronavirus disease 2019 (COVID-19) is the first pandemic in history where technologies and social media are used on a large scale to make people safe, informed, productive, and connected. At the same time, these technologies enabled the rise of the infodemic, which endangered pandemic control. This study aimed to assess COVID-19 information exposure in the community, the efforts to find related information in online media, and COVID-19 preventive behavior. A cross-sectional study was conducted with 909 participants in Indonesia using the consecutive sampling technique. Data were collected using a questionnaire distributed through social media (WhatsApp, Instagram, and Facebook) and analyzed using univariate analysis, bivariate analysis (Chi-square test), and multivariate analysis (multiple logistic regression). The results showed that about 838 (92.2%) participants said they often or always obtain information about COVID-19 online, 662 (72.8%) participants stated that information from online sources increased their knowledge of the disease, and 728 (80.1%) said that online information enabled them to make preventive efforts. Marital status (AOR = 1.81, p-value = 0.002) and perceived susceptibility (AOR = 1.42, p-value = 0.011) were the most influential factors for COVID-19 preventive behaviors. Information sources and channels frequently accessed by the community must be professionally managed by the government as valuable tools for mitigating an epidemic or pandemic.

Keywords: channel of information, health promotion, mitigation, preventive behavior

Introduction

During the coronavirus disease 2019 (COVID-19) pandemic, abundant related information is spread. This condition is often referred to as an infodemic.[1] An infodemic can cause public health problems by affecting the effectiveness of programs or initiatives aimed at citizens' health, campaigns, awareness, and welfare.[2,3] People use the internet as the main reference to receive the most up-to-date information on COVID-19.[4] The new media theory by Mark Poster proposes that Web 2.0 and its supporting technologies—primarily related to an internet connection—have a unique character that can alter human communication.[5] It can further expand the flow of information through social media because people can now freely become information providers themselves, as one of the characteristics of new media is that they are decentralized and user-generated (e.g., information sources do not have to come from government or mass media companies but could also be generated from the people who further spread the information they attain).[5] Another question for public health is whether the infodemic generally protects people through its information.

Online media, especially social media, is one of the leading platforms available for health promotion.[6] Online media has become one of the channels used to change behavior, but changing behavior is complex. The Health Belief Model explains how people can undertake preventive behavior as instructed.[7] This model shows the importance of seeing how far the information attained can awaken perceived susceptibility and severity in this pandemic.[7] Thus, this study aimed to investigate information exposure in the community, the efforts to find information in online media, and preventive behaviors during the COVID-19 pandemic in Indonesia.

Method

A cross-sectional online study was performed to assess COVID-19 information exposure from online media, the efforts of people to seek information, and the determinants of prevention behaviors for COVID-19. All participants were selected using consecutive sampling under the following inclusion criteria: an Indonesian citizen

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aged at least 18 years old, lived in Indonesia during the data collection period, and willing to participate as stated in informed consent.

The population number was attained by Statistics Indonesia in 2010 (237,641,326 people).[8] The minimum sample size was calculated with the formula using OpenEpi version 3 with a confidence interval (CI) of 95%, resulting in 1,083 respondents. To anticipate incomplete surveys, added 10%; therefore, the total minimum sample was 1,191 participants.

The data were collected using a questionnaire addressing: 1) the demographic characteristics of the participant, including sex, origin, residence, age, marital status, education, and occupation; 2) efforts to seek out information, sources of information, the information sought, and responses and feelings about the information; 3) knowledge of COVID-19 transmission, assessed by 16 items ("correct," "incorrect," or "do not know"); 4) perceived benefits of information and perceived severity and perceived susceptibility of COVID-19, assessed by 11 items using a Likert scale ("strongly agree," "agree," "hesitate," "disagree," or "strongly disagree"); and 5) preventive behavior for COVID-19, assessed by 10 items ("always," "often," "sometimes," or "never").

These variables were assessed using the median point, resulting in two categories for knowledge (poor and good), perceived benefits to information (beneficial and not beneficial), perceived severity of COVID-19 (did not trigger fear and triggered fear), perceived susceptibility to COVID-19 (susceptible and not susceptible), and preventive behavior (poor and good). The demographic characteristics of the participants, knowledge, and perception of COVID-19 became the independent variables. Preventive behavior for COVID-19 became the dependent variable. Referring to the definition of infodemic from the World Health Organization,[1,9] this study categorized participants who said they often or always get information on COVID-19 online as experiencing an infodemic. Conversely, if participants stated that they had never or rarely been exposed to information on COVID-19, they were not in the infodemic category. The questionnaires were tested on 22 respondents for validity (Pearson's correlation) and reliability (Cronbach's alpha >0.60).

The data were collected online and distributed through social media (WhatsApp, Instagram, and Facebook) during the second through fourth weeks of July 2020. Invitations to take part in the survey were distributed through social media. The eligible participants were then asked to complete the questionnaire. They were also asked to share the questionnaire link with others. The questionnaire link distribution continued until the required number of samples was met.

The data were analyzed using free version of SPSS version 25. Descriptive statistics were used for the frequency, proportion, mean, median, and standard deviation. The Chi-square test was used to examine the independent and dependent variables' relationship and identify the significant factors (p-value<0.05). The significant factors were then included in the multivariate analysis (binary logistic regression model) to determine the predictors of COVID-19 preventive behavior, indicated by the adjusted odds ratio (AOR) and a p-value of <0.05.

Results

Of the 909 participants, the majority were female (76.3%), from Bali (53.9%), living in urban areas (68.2%), finished with their undergraduate studies (45%), married (49.9%), working in the private sector (31.5%), and aged 21–30 years old (51.59%) (Table 1) (see Supplementary Files in Availability of Data and Materials).

About 92.2% of the participants said they often or always obtain information on COVID-19 online. For information references, 80.1% of participants stated that they receive information from official government sources and 59.3% from study articles. The preferred forms of COVID-19-related information were infographics (56.4%), video (39.8%), and audio (3.7%). For information sharing, 39.9% of the respondents rarely did it, 27.8% sometimes, 18.8% often, 11.1% never, and 6.4% very often (see Supplementary Files in Availability of Data and Materials).

This study showed that information seeking was done on conventional online news portals (44.9%), non-conventional online news versions (34.0%), and online chat applications (35.0%). Information seeking through social media was done very often (42.2%). Frequently sought COVID-19-related information was about pre-

Table 1. Participants' Demographic Characteristics (n = 909)

Variable	Category	n	%
Sex	Male	215	23.7
	Female	694	76.3
Origin	Western Indonesia	320	35.2
	Central and Eastern Indonesia	589	64.8
Residence	Rural	289	31.8
	Urban	620	68.2
Age	≤20 years	78	8.6
	21–30 years	469	51.6
	31–40 years	204	22.4
	≥40 years	158	17.4
Marital status	Single	442	48.6
	Married	467	51.4
Education	Primary education	205	22.6
	Higher education	704	77.4
Occupation	Student	195	21.5
	Unemployed	91	10.0
	Private sector	286	31.5
	Civil servant	211	23.2
	Others (farmers, teachers, lecturers, drivers, and others)	126	13.9

Table 2. Preventive Behavior for COVID-19 Based on Demographic Characteristics, Knowledge, and Perception (n = 909)

Variable	Category	Preventive Behavior for COVID-19		p-values
		Good (n = 456) (≥Median)	Poor (n = 453) (<Median)	
Sex	Male	101 (46.98)	114 (53.02)	.
	Female	355 (51.15)	339 (48.85)	0.285
Education	Primary education	91 (44.39)	114 (55.61)	.
	Higher education	365 (51.85)	339 (48.15)	0.061
Origin	Western Indonesia	154 (48.13)	166 (51.88)	.
	Central and Eastern Indonesia	302 (51.27)	287 (48.73)	0.365
Residence	Urban	149 (51.56)	140 (48.44)	.
	Rural	307 (49.52)	313 (50.48)	0.567
Occupation	Student	82 (42.05)	95 (45.02)	0.009
	Unemployed	48 (52.75)	43 (47.25)	0.721
	Others	71 (56.35)	55 (43.65)	0.806
	Private sector	139 (48.60)	147 (51.40)	0.160
	Civil Servant	116 (54.98)	95 (45.02)	.
Marital status	Single	190 (42.99)	252 (57.01)	.
	Married	266 (56.96)	201 (43.04)	0.000
Age	≤20 years	29 (37.18)	49 (62.82)	.
	21–30 years	231 (49.25)	238 (50.75)	0.050
	31–40 years	96 (47.06)	108 (52.94)	0.136
	≥40 years	100 (63.29)	58 (36.71)	0.000
Knowledge (mean±SD)		15.09 (1.14)	14.71 (1.65)	0.000
	Poor	110 (44.18)	139 (55.82)	.
	Good	346 (52.42)	314 (47.58)	0.046
Perceived benefits of information	Beneficial	447 (50.39)	440 (49.61)	0.382
	Not beneficial	9 (40.91)	13 (59.09)	.
Perceived severity of COVID-19 (mean±SD)		12.31 (2.95)	11.89 (2.78)	0.027
	Did not trigger fear	154 (47.38)	171 (52.62)	.
	Triggered fear	302 (51.71)	282 (48.29)	0.211
Perceived susceptibility to COVID-19 (mean±SD)		19.14 (4.99)	18.09 (4.31)	0.001
	Susceptible	205 (45.66)	244 (54.34)	
	Not susceptible	251 (54.57)	209 (45.43)	0.007

vention efforts (health protocols such as using masks, hand washing, and physical distancing), at approximately 60.3%.

This study showed that most respondents (93.4%) read the titles and articles, and 76.0% rechecked the information's correctness by searching for clarification from online news portals. Confusion, ordinary feelings, and anxiety were the three most frequent responses when obtaining COVID-19 information. Most participants (72.8%) perceived that the information increased their knowledge, and 80.1% stated that it enabled them to make preventive efforts. Nevertheless, only 48.6% of the respondents confirmed their ability to perform management measures if exposed to COVID-19, while 50.4% felt that the information could reduce anxiety. This study showed that the majority agreed and feared COVID-19 (38.8%), mostly the fear of losing their life (53.0%). The inconvenience was felt by 41.6% of respondents, and sleep disturbance happened to 5.8%.

Table 2 shows that risk factors associated with COVID-19 preventive behavior were age, marital status, occupation, knowledge, perceived severity, and perceived susceptibility (p-value<0.05). In the modeling to see the influence of all variables associated with COVID-19 preventive behavior, this study used a p-value limit of <0.25. Table 3 shows that the model 2 results, which had an AOR and 95% CI, did not pass. When together, marital status (p-value = 0.002) and perceived susceptibility (p-value = 0.011) were the most influencing factors for the respondents' COVID-19 preventive behaviors.

Discussion

This study assessed the COVID-19 information flow and channels from online media, information-seeking behavior, and determinants of preventive behavior during the pandemic. The findings showed that the information was primarily obtained from credible sources, and despite increasing anxiety, the information could enhance knowledge and ability in prevention. During the COVID-19 pandemic, online media was one of the main sources of information widely accessed by people. In this study, social media was the most frequently accessed. Social media has emerged as a vital technology for disaster risk reduction, including preparedness, response, and re-

Table 3. Influence of Demographic Characteristics, Knowledge, and Perception on Preventive Behavior for COVID-19 (n = 909)

Variable		Model 1	Model 2
		Crude OR (95% CI)	Adjusted OR (95% CI)
Knowledge	Poor	ref	ref
	Good	1.39 (1.03–1.86)	1.26 (0.93–1.72)
Perceived severity	Did not fear	ref	ref
	Fear	1.19 (0.91–1.56)	1.21 (0.85–1.48)
Perceived susceptibility	Susceptible	ref	ref
	Not susceptible	1.43 (1.11–1.85)	1.42 (1.08–1.85)
Occupation	Civil servant	ref	ref
	Private sector	0.77 (0.54–1.11)	0.93 (0.61–1.42)
	Student	0.59 (0.40–0.88)	1.04 (0.58–1.88)
	Not working	0.92 (0.59–1.49)	1.02 (0.59–1.76)
	Others	1.05 (0.68–1.64)	1.14 (0.70–1.86)
Marital status	Single	ref	ref
	Married	1.75 (1.35–2.28)	1.81 (1.25–2.61)
Age	≤20 years	ref	ref
	21–30 years	1.64 (1.01–2.68)	1.31 (0.73–2.36)
	31–40 years	1.50 (0.88–2.56)	0.81 (0.39–1.65)
	≥40 years	2.91 (1.66–5.10)	1.56 (0.75–3.23)

Notes: OR = Odd Ratio, CI = Confidence Interval

covery activities.[10] Twitter (65%) was by far the dominant social media platform used in other countries for study around disaster recovery, followed by Facebook (16%).[10]

In crises and disasters, communities often use social media platforms to stay connected, share experiences, and access vital information and resources to support disaster response and recovery.[10] These platforms have become even more helpful for disaster-impacted communities to stay connected in the global pandemic. Indeed, social media appears as a useful tool for public health.[11-13] It can also act as a surveillance tool for disease control and mitigation, increase access to screening and disease management, and provide peer support and bridge human connections during an epidemic.[11]

An infodemic refers to too much information, including false or misleading information, in digital and physical environments during a disease outbreak. It causes confusion and risk-taking behaviors that can harm health.[2] This study found that respondents acquired extensive information on COVID-19 online, especially from social media. For COVID-19, social media can be crucial in disseminating health information and tackling infodemics and misinformation.[14] Most respondents had not yet experienced misinformation due to the infodemic. The majority said that their sources of information were mostly trusted, with government and research sites as the two main references. It might be because most respondents had a high education level; thus, they could choose reliable information sources.

Misinformation was mainly driven by rumors, stigma, and conspiracy theories circulating on social media and other online platforms.[15] Kouzy, *et al.,* revealed that misinformation accounted for 24.8% (153 of 617) of all serious tweets (e.g., not humor-related posts). Tweets from unverified Twitter accounts contained more misinformation (31.0% versus 12.6% for verified accounts, p-value<0.001). Tweets from healthcare/public health accounts had the lowest rate of unverifiable information (12.3%, p-value = 0.04).[16] This study also found that most respondents felt that the COVID-19 information they received increased their knowledge and ability to take preventive measures. Social media is crucial in people's perceptions of disease exposure, resultant decision-making, and risk behaviors.[17,18] Exposure to media can increase preventive behaviors against COVID-19.[19]

In this study, perceived susceptibility and marital status influenced the preventive behavior for COVID-19 transmission. This result aligns with the study by Eichenberg, *et al.*, which found that a higher perceived susceptibility level positively correlates to compliance with protective measures.[20] Study by Leung, *et al.*, also found that a higher perception of susceptibility to severe acute respiratory syndrome was a positive and significant predictor of prevention behavior and health service utilization.[21] In addition, study by Kim and Kim in Korea showed that the number of children in a family positively affected COVID-19 prevention behavior.[19] As people become more in touch with those prone to COVID-19, they will increasingly take action to prevent the disease.[19] Increased COVID-19 information exposure was significantly related to increased fear of COVID-19; the fear

was related to the safety of the self and loved ones.[22]

Health promotion is more important than ever to fight COVID-19. Health promotion will continue to be crucial beyond the pandemic; therefore, using the latest technology with the human touch must be carefully balanced to ensure successful future health promotion efforts.[23] Government responses disseminated over social media have been increasingly crucial in combating infodemics and promoting accurate and reliable information for the public. It also remains unknown whether government posts would reach greater numbers of social media users or have greater effects on them than infodemics would.[24]

Health information providers must provide unambiguous communication about health risks and prevention measures,[22] including escalating the spread of accurate health information through various online media and strengthening regulations to protect people from misinformation and disinformation.[12,13,25,26] In order to be considered credible, social media platforms from the government should share data with behavioral and public health researchers to understand the effects of such policies on both online and offline behaviors.[24]

These findings can give insight into developing health messages and choosing the proper channels to facilitate sustainable preventive behaviors in the community post-pandemic situation. This study had several limitations. The online survey made the results prone to respondent bias. The number of samples was 1,191, but only 909 could be processed due to missing data. The sample distribution was not even, so it was less representative.

Conclusion

Most respondents have not yet experienced misinformation due to the infodemic because they searched for information from relevant and credible sources (government and researchers). However, it is undeniable that the information had a psychological impact that cannot be resolved by the information they read. Marital status and perceived susceptibility are the determinants of preventive behaviors for COVID-19 transmission. Information sources and channels frequently accessed by the community must be professionally managed as valuable tools for mitigating an epidemic or pandemic in the post-COVID-19 era.

Abbreviations

COVID-19: coronavirus disease 2019; CI: Confidence Interval; AOR: Adjusted Odds Ratio.

Ethics Approval and Consent to Participate

This study received ethical approval (no: 1528/UN14.2.2.VII.14/LT/2020 dated 20 July 2020) from the Ethical Commission of the Faculty of Medicine Udayana University. The participants provided their written informed consent to participate in this study.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data supporting this study's findings are available on request from the author due to privacy restrictions. The data are not publicly available because they contain information that could compromise the privacy of the research participants. The Supplementary files can be accessed by clicking the word "Supplementary".

Authors' Contribution

Conceptualization: DPYK, PAI, PPJ, MSY. Data curation: DPYK, KSS, MSY. Formal analysis: DPYK, PEP, MSY. Funding acquisition: PAI, PPJ. Methodology: PAI, PEP, LPSU. Project administration: PEP, LPSU. Visualization: PEP, PAI. Writing–original draft: DPYK, PEP, PAI, KSS. Writing–review and editing: DPYK, PEP, PAI, LPSU, KSS.

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The Influence and Feasibility of Therapeutic Exercise Videos at Home on the Functional Status of Post-COVID-19 Hospitalization

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Abstract

The COVID-19 pandemic pushed physicians to modify conventional practices to reduce the exposure and risk of infection among patients and health workers. Telemedicine is one of the safest methods, and telerehabilitation could prevent the sequelae of COVID-19. A quasi-experimental study with randomized sampling without masking/blinding was conducted. The study was conducted from August 2021 to March 2022 at Hospital A in Pekanbaru, Hospital B in Jayapura, and Hospital C in Jakarta, Indonesia. A total of 27 patients were recruited and divided into control and intervention groups. The control group was given conventional education on therapeutic exercise at home, while the intervention group was shown educational videos about therapeutic exercise at home. The comparison of all functional outcomes between the two groups after the intervention showed a significant difference. The intervention group improved more than the control group, except for the fatigue severity scale. Most of the responses showed that this video was feasible and useful and did not need to be supervised by health workers. Therapeutic exercise educational videos can be an option to deliver rehabilitation programs for post-COVID-19 hospitalized patients.

Keywords: educational video, post-COVID-19, rehabilitation, telerehabilitation, therapeutic exercise

Introduction

The coronavirus disease (COVID-19) is a highly contagious lung infectious disease, so much so that the World Health Organization (WHO) declared the spread of this disease as a pandemic in March 2020. It affects multiple systemic conditions, and some of its effects are long-lasting.[1] One of the most common symptoms is deconditioning the respiratory, cardiovascular, musculoskeletal, and psychological systems, ultimately reducing functional capacity.[2]

A functional capacity evaluation (FCE) systematically measures a person's ability to perform work activities safely.[3] The six-minute walk test (6MWT) is one of the simplest FCEs. This activity measures the walking distance on a flat, hard surface in six minutes, assesses the distance traveled for six minutes, and describes the response of the cardiopulmonary and musculoskeletal systems involved during the exercise. Furthermore, functional capacity can be assessed using a sit-to-stand test to assess lower endurance and mobilization ability if the person cannot accomplish the 6MWT.[4]

During the pandemic, there were several adaptations in the provision of medical providers (e.g., personal protective equipment, education materials via social media platforms, and negative pressure isolation rooms). Telerehabilitation provides rehabilitation and habilitation services through information and communication technology.[5,6] This study aimed to determine the effect and feasibility of providing therapeutic exercise educational videos on functional capacity in post–COVID-19 hospitalization. These findings will support the home program of telerehabilitation for post–COVID-19 patients.

Method

This study was a multicenter quasi-experimental pilot study with consecutive sampling without masking/blinding to analyze the effect of educational videos on therapeutic exercises on the functional status of the subjects after COVID-19 hospitalization. The outcomes were measured by physical medicine and rehabilitation specialists using the 6MWT, oxygen saturation, the Borg scale, the 30-second sit-to-stand test (30s STS), the fa-

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tigue severity scale (FSS), and the Barthel index upon discharge and after seven days of intervention. The study was conducted from August 2021 to March 2022 at Hospital A in Pekanbaru, Hospital B in Jayapura, and Hospital C in Jakarta.

In this study, the subjects were divided into two groups, consisting of the intervention and control groups. The sampling method was consecutive sampling with the inclusion criteria of aged ≥18 years, discharged after moderate to severe COVID-19 hospitalization, and able to walk, as well as the exclusion criteria of not consenting to the study, having a mental or physical disability that hindered mobilization, musculoskeletal pain, severe cardiovascular or neurological problems, and pregnancy.

The control group was given conventional educational therapy only (without videos) about therapeutic exercises that can be done at home. The intervention group was given educational therapy using a video that can be watched on a smartphone about therapeutic exercises that can be done at home. The exercise frequency was 2–3 times a day with 5–10 repetitions for each movement. Both groups were given the same exercise prescription.

Three levels of exercise can be done based on the participants' functional level. Level 1 was given to those who could not perform the 30s STS, level 2 was for those who could perform the 30s STS but had below-average results, and level 3 was for those who could perform the 30s STS with average results based on age. All the participants were asked to do the therapeutic exercise at home and fill in the logbook form to monitor their compliance. The logbook consisted of the day of the exercise and vital signs before and after the exercise (blood pressure, heart rate, and oxygen saturation).

The functional status was measured upon discharge and seven days after discharge using the following methods:

- The 6MWT is a submaximal cardiopulmonary functional testing modality. It measures the distance an individual can walk as fast as possible, in six minutes, on a 100-foot (30 meters) flat surface.[7]
- Oxygen saturation is a measure of how much hemoglobin is currently bound to oxygen compared to the amount of unbound hemoglobin, presented in percentage (%).[8]
- The Borg scale is a self-reported measure to select perceived exertion and dyspnea ratings. The perceived exertion rate ranges from 6 to 20, with a higher scale indicating more vigorous activity. The dyspnea rating is on a scale of 0 to 10, with a higher scale indicating severe shortness of breath.[9,10]
- The 30s STS examines the ability of an individual to stand up from a sitting position repeatedly in 30 seconds. It is a simple tool to investigate lower limb strength and functionality.[11]
- The FSS is a tool to measure the impact of fatigue on an individual. It consists of nine questions, with total scores ranging from 9 to 63, and the cutoff score of 36 indicates that the individual is suffering from fatigue.[12]
- The Barthel index is an ordinal scale that measures functional independence regarding personal care and mobility. It consists of 10 items, with scores ranging from 0 to 100 (a higher score means greater independency).[13]

Additionally, the feasibility of this educational therapy method using a video was evaluated using a questionnaire filled out only by the intervention group. The questionnaire is a technology acceptance model (TAM) questionnaire with a convergent validity value measured by AVE (average variance extracted) = 0.7.

All statistical analyses were conducted using the free version of IBM SPSS 22.0 (IBM Corp., Armonk, NY, USA). Univariate analysis was used to describe the participants' characteristics and all variables. The 6MWT was measured in meters, the 30s STS in times, and the FSS and Barthel index by their scores. A paired t-test was used to compare the value for normally distributed data. Alternatively, the Wilcoxon test was used. The data is presented in mean±SD or confidence interval (CI) 95%, with a p-value<0.05 considered significant.

Result

A total of 27 participants were enrolled in this study. Table 1 shows that most participants were male, with a mean age of 53.56 years, and graduated from senior high school. This study was dominated by participants with normal and grade I obesity. About 85% had comorbid lung disease, while 18.5% had a metabolic disease. This table also shows that the caregiver category is dominated by wives (51.9%), most of whom had diploma degrees (40.7%) and spent full days taking care of the participants (70.4%).

The distribution of the outcome indicator was normal, and the data set was homogenous for both groups before the intervention. The variables consisted of walking distance (meters), repetitions of the 30 STS, percentage of oxygen saturation, Barthel index score, and FSS score. Table 2 shows that the comparison of functional outcomes before and after the intervention was significantly improved. There was no significant difference in FSS.

Figure 1 shows the functional outcomes' improvement after one week of intervention in both groups. The control group showed improvement, although this was not statistically significant. Otherwise, the intervention group showed significant improvement in all the functional outcomes. This study also evaluated the feasibility of the therapeutic exercise video. Most responses showed

that this video was feasible and useful and did not need to be supervised by health workers (Figure 2).

Table 1. Participants' Characteristics (n = 27)

Variable	Category	%	Mean±SD
Age (years)			53.74±17.02
Sex	Female	44.4	
	Male	55.6	
Body mass index	Underweight	3.7	
	Normal	29.6	
	Overweight with risk	14.8	
	Obesity I	29.6	
	Obesity II	22.2	
Education	Elementary school	11.1	
	Junior high school	3.7	
	Senior high school	33.3	
	Diploma	18.5	
	Bachelor's	22.2	
	Master's	7.4	
	Uneducated	3.7	
Occupation	Civil servant	11.1	
	Housewife	18.5	
	Entrepreneur	22.2	
	Retired	11.1	
	Private employee	37	
Comorbid	Lungs	81.5	
	Metabolic	18.5	
Caregiver status			
Relationship	Wife	51.9	
	Husband	14.8	
	Child	29.6	
	Relatives	3.7	
Education	Junior high school	3.7	
	Senior high school	18.5	
	Diploma	40.7	
	Bachelor	37	
Occupation	Housewife	51.9	
	Student	7.4	
	Civil servant	7.4	
	Private employee	18.5	
	Entrepreneur	11.1	
	Retired	3.7	
Duration of care	Full day (≥16 hours)	70.4	
	Half-day (8–16 hours)	29.6	

Note: SD = Standard Deviation

Discussion

Tanguay, *et al.*,[14] found that people with COVID-19 still faced moderate to severe pulmonary and functional disabilities when returning home after hospitalization. The clinical profiles of the participants were heterogeneous since some required spending several weeks in intensive care while others required only a short hospital stay. These differences may explain the wide range of disabilities across domains among our participants at the beginning of the intervention. Still, other factors may also explain these differences (e.g., pre-existing comorbidities, age).

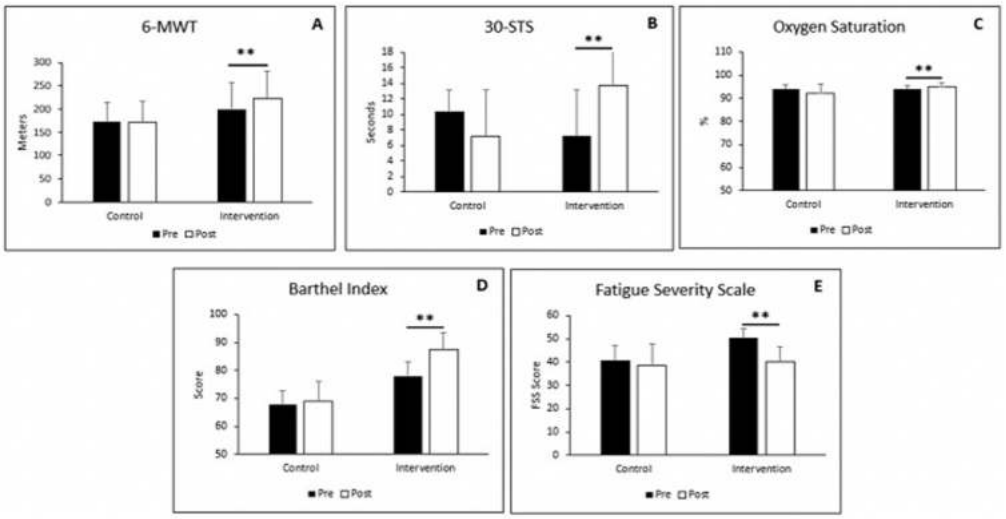
The criteria for people with COVID-19 who should be hospitalized are dyspnea or increased respiratory rate (≥30 breaths per minute), 94% oxygen saturation or decreased saturation to <90% with ambulation, and a high risk for respiratory failure.[15] For COVID-19 hospitalized patients, respiratory rehabilitation aims to improve symptoms of dyspnea, relieve anxiety and depression, reduce complications, prevent and improve dysfunction, reduce disability, preserve function to the maximum extent, and improve quality of life.[16-18] This study's participant characteristics were in line with studies by Hasani Azad, *et al.*,[19] and Khamis, *et al.*[20] The dominant COVID-19 inpatients were men, with the most common comorbidities including hypertension (51.3%), diabetes mellitus (49.8%), dyslipidemia (21.6%), and heart disease (20.9%).[21,22]

Telerehabilitation is an ideal healthcare delivery method as it can provide safe, long-distance services, adhere to the pandemic's sanitary measures, and cover a large geographic region.[14] Paneroni, *et al.*,[21] involved 25 COVID-19 survivors provided with telerehabilitation services in the form of exercise and lifestyle education for one hour daily. After one month of telerehabilitation, an improvement in exercise tolerance and dyspnea was found.[21] No side effects were encountered during the

Table 2. Comparison of Functional Outcome Before and After Intervention between Control and Intervention Groups

Variable	Group	Mean±SD		Sig (2-tailed)
		Before Intervention	After Intervention	
6MWT (meters)	Control	171.92±41.87	172.7±42.61	0.021
	Intervention	199.20±56.58	222.8±59.04	
30s STS (times)	Control	10.42±2.71	7.25±5.83	0.002
	Intervention	7.25±5.83	13.8±4.32	
Saturation (%)	Control	93.83±2.04	92.1±4.12	0.012
	Intervention	93.80±1.74	95.2±1.61	
Barthel index (score)	Control	67.75±5.06	69.1±6.86	<0.001
	Intervention	78.07±5.11	87.6±5.95	
FSS (score)	Control	40.67±6.21	38.4±9.33	0.611
	Intervention	50.47±3.93	40±6.67	

Notes: SD = Standard Deviation, 6MWT = Six-minute Walk Test, 30s STS = 30-Second Sit-to-Stand Test, FSS = Fatigue Severity Scale.



Notes: **p-value <0.01

Figure 1. Functional Outcomes of the Control and Intervention Groups

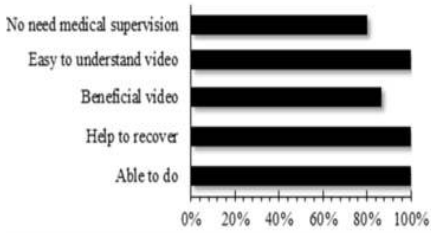


Figure 2. The Feasibility Study

study, and the results confirmed the feasibility and safety of a special telerehabilitation program for COVID-19 pneumonia survivors.[21] The current study also shows that a telerehabilitation program using a video can improve the functional outcomes of and is safe for post-COVID-19 patients with histories of hospitalization.

The assessment tools to evaluate functional outcomes in patients with COVID-19 are the Barthel index, the Functional Independence Measure, the 6MWT, and the 30s STS. Spirometry and lung diffusion capacity for carbon monoxide determination have been used to assess respiratory function in persons with COVID-19.[22]

The recorded walking distance in this study before the intervention was 171.92±41.8 meters in the control group and 199.20±56.6 meters in the intervention group. This result was in line with the study of Chikhanie, *et al.*, wherein the walking distance of post-COVID-19 patients in the ICU was 138.7±144.4 meters.[23] After the intervention, the walking distance increased to 0.75 meters for the control group and 23.6 meters for the intervention group. Based on the study by Bohannon, *et al.*,[24] the minimal clinically important difference (MCID) for change in the 6MWT distance of adults with pathology was 14–30.5 meters. The walking distance improvement in the intervention group can reach the MCID of the 6MWT and the statistically significant difference compared to the control group.[23,24]

The Barthel index before and after the intervention was improved in both groups, especially in the intervention group. The delta of the control group versus that of the intervention group was 1.33 (67.75±5 to 69.08±6.8) versus 9.53 (78.07±5.1 to 87.6±5.9), showing a significant difference between the two groups. The oxygen saturation in this study was similar in both groups (93.83% ±2.0% in the control group and 93.80%±1.7% in the intervention group) before the intervention. Improvement was seen only in the intervention group (1.4%), with a significant difference from the control group (–1.75%). Bohannon, *et al.*, showed that the oxygen saturation improved by 3% before and after the pursed-lips breathing exercise (acute effect).[24]

Fernández-de-Las-Peñas, *et al.*, found that 70% of hospitalized persons with COVID-19 exhibited fatigue and/or shortness of breath seven months after hospitalization.[25] Furthermore, 45% reported at least one limitation in their daily activities. This study confirms that prolonged fatigue and shortness of breath become highly common long-term symptoms after hospital discharge, supporting the assumption that they can be persistent post–COVID-19 symptoms.[26]

Rehabilitation after critical illness is a key component in the continuum of care. Consensus-based guidelines suggest that as important as post-discharge rehabilitation is, initial inpatient-tailored rehabilitation interventions, including early mobilization and clearing of the airway, should be initiated during hospitalization.[26] Green, *et al.,* suggest that if the participant does not have independent sitting balance, then "phase 1" mobilization should begin with sitting balance exercises, an inclined table, and muscle strengthening exercises.[27] Those with independent sitting balance can progress to weight-bearing supported/active "phase 2" mobilization, with exercises including "sit–stand," line-up, or gait assistance.[27] Early active mobilization was associated with increased muscle strength, better mobility status on discharge, and more days after discharge.[27]

Previous studies revealed that the exercises are easy to do and understand by the participants. Those who participated in this study had primary school, secondary school, and tertiary school educational backgrounds, and one participant did not have an educational background.[16,27] Almost all the outcome parameters in this study's intervention group increased significantly compared to those in the control group. One can presume that the intervention group had better outcomes because of the clear video with simple narratives explaining the exercises, which can be replayed. This makes it easier for the subjects to follow the exercise properly at home, thus improving compliance.

It is important to do the correct exercise to achieve the desired results. Telerehabilitation may ease the continuity of care, but physicians may have some limitations in giving feedback on whether the exercise has been performed correctly. Therefore, the role of the caregiver should be emphasized in telerehabilitation, not only for general supervision but also to assess and correct exercise movement.

The feasibility evaluation also showed that most participants thought the home telerehabilitation program was feasible, beneficial, and easy to understand. Incorporating educational videos in telerehabilitation is more cost-effective and efficient in targeting successful home programs than conventional methods. Health workers can choose from various video delivery methods: DVDs, uploading to a website, or developing specific applications. However, there are some constraints to using telerehabilitation. For instance, it only applies to participants with smartphones and internet connections, and those with multiple comorbid or special conditions might need tailored exercise.

The weaknesses of this study included the low number of subjects and the use of consecutive sampling (which could not represent the general population of COVID-19 patients). This study also did not measure the long-term effects of this program. On the other hand, one strength of this study is that it was conducted in multiple health centers. To the authors' knowledge, this study was the first on post-COVID-19 multicenter telerehabilitation using a home program educational video in Indonesia. Further studies need to consider the method's long-term effects and a larger population.

Conclusion

Significant functional improvement can be observed after one week of therapeutic exercise as instructed through videos at home compared to the conventional method. Therapeutic exercise educational videos can be an option to deliver rehabilitation programs for post–COVID-19 hospitalized patients. Overall, this study shows that telerehabilitation using video education is feasible and can improve the functional status of post-COVID-19 hospitalized patients.

Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; 30s STS: 30-second Sit-to-Stand Test; 6MWT: Six-Minute Walk Test; FSS: Fatigue Severity Scale; SD: Standard Deviation; CI: Confidence Interval; ADL: Activity of Daily Living; MCID: Minimal Clinically Important Difference.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of the Faculty of Medicine Universitas Indonesia—Dr. Cipto Mangunkusumo National Referral Public Hospital (protocol number 21-07-0770 and date of approval 09/13/2021). Informed consent was obtained from all the participants involved in the study. Written informed consent was also obtained from the patients to publish this paper.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The data presented in this study is available in this article.

Authors' Contribution

Conceptualization: LKW; methodology: MH, PS, and IF; software: OH and IW; validation: LKW, MH, PS, and BN; formal analysis: MR and BN; investigation: MH, PS, IF, OH, and IW; resources: MH, PS, IF, OH, and IW; data curation: MR and BN; writing—original draft preparation: MH, PS, and IF; writing—review and editing: OH, IW, BN, DT, and TZT; visualization: MR and BN; supervision: LKW; project administration: BN.

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Epidemiology of Celiac Disease in Northern Morocco in 2018–2021: A Descriptive Cross-Sectional Study

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Abstract

Celiac disease is an autoimmune disease caused by gluten. This retrospective cross-sectional study with descriptive and analytical aims was conducted over three years, from 2018 to 2021. The participants were 280 patients diagnosed with celiac disease registered in the Gluten Intolerant and Allergic Association of the North in the Tangier-Tetouan-Al Hoceima region. The prevalence and incidence of celiac disease in this region were 1/135 and 1/253, respectively. The average age was 21.18±1.13, and the first symptoms appeared between 10 and 25 years. The data showed a female predominance of 68% versus 32% for males, with a male/female sex ratio of 0.45. The clinical signs of celiac disease manifested more in gastrointestinal symptoms. This study obtained data on 22.6% of microcytic hypochromic anemia patients and 40.7% of *Helicobacter pylori* infections. In addition to celiac disease, the patients showed other pathologies with different rates: repeated spontaneous abortions (2.14%), type 1 diabetes mellitus (1.42%), autism (1.42%), dermatitis herpetiformis (0.72%), cancer (0.72%), and epilepsy (0.35%). Serologically, anti-transglutaminase antibodies were positive in 47.2% of patients. Analyses of histological data from intestinal biopsies from 141 patients were positive in 50.8% of patients. There was a weak correlation between the serological profile and the degree of atrophy.

Keywords: celiac disease, histological, incidence, prevalence, serological

Introduction

Celiac disease (CD) is an immune-mediated response to gluten in wheat, barley, and rye.[1] Following SARS-CoV-2 infection, genetically predisposed people may be more likely to acquire CD, making COVID-19 a candidate for blame in the event of a CD epidemic in the near future.[2] The risk of CD varies within countries.[3] The CD has long been considered a pediatric disease, although it is common at all ages.[4] The incidence of CD is increasing internationally, but the causes of this are yet unknown.[5]

There has been a significant increase in new cases of this disease thanks to improved diagnostic tools and the early screening of people at risk.[6] The diagnosis of this disease is based on a combination of clinical evidence, serological tests, duodenal biopsies,[7] and responses to the gluten-free diet (GFD).[8] It is crucial to keep in mind that all symptoms should be considered important in the beginning.[9] Then, anti-transglutaminase, anti-gliadin, or anti-endomysium antibodies are checked in case of suspicion.[10] To confirm the diagnosis, a small bowel biopsy is recommended if the serological tests are positive.[8] Serology is beneficial but does not replace a duodenal biopsy, which is still necessary.[11] The biopsy is histologically characterized by villous atrophy of the duodenal and crypt hyperplasia.[12] The clinical remission obtained in the months following the introduction of a GFD contributes to the positive diagnosis.[13]

The CD can be detected in patients with anemia, growth retardation, and autoimmune disorders.[14] Once the diagnosis has been made, an additional workup is necessary to detect possible deficiencies such as anemia, hyposideremia, and hypogammaglobulinemia. The complications of CD are numerous; they can concern nutrition, hematology, and bone. CD can be associated with other autoimmune diseases, including thyroiditis, type 1 diabetes mellitus (T1DM), and other serious diseases such as cancer.[15] However, CD in adults is often discovered at the stage of complications. It is estimated that there are many more undiagnosed cases than diagnosed cases.[15] A GFD for life largely protects against most complications and corrects excess mortality.[16] This diet is difficult to follow for several reasons, so that many recent strategies have been developed to tackle the problems in gluten-free diets and products.[17]

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In Morocco, few studies have been conducted on CD. In the north of the country, specifically in Tangier, very little data were published on this disease. In this context, this study focused on determining the demographic, clinical, serological, and histological characteristics of CD in the Tangier population, including the period of COVID-19. Several scientific publications on CD were published during the 2020–2021 COVID-19 pandemic, but the impact of the virus on CD incidence is unknown.

Method

This retrospective cross-sectional study with descriptive and analytical aims was conducted over three years (2018–2021). The population of the study during that period of time was 3,791,551 inhabitants of the Tangier-Tetouan-Al Hoceima region. The study involved 280 Moroccan patients with CD aged from one month to 63 years, lived in rural and urban areas of the TTA region, experienced similar social and economic conditions, and was registered with the Association of Gluten Intolerant and Allergic of the North (GIAAN).

Data were collected using a questionnaire that included sociodemographic, clinical, immunological, and histological parameters, as well as the results of the analyses prescribed by a doctor of patients from the GIAAN (Figure 1). Clinical manifestations from 220 patients were recorded, including gastrointestinal symptoms (e.g., abdominal bloating, diarrhea) and non-gastrointestinal symptoms (e.g., bone pain, delayed growth). Due to COVID-19 restrictions, a Google Forms questionnaire was distributed through social media to facilitate data collection. Immuno-serological parameters were analyzed in 180 patients, including anti-transglutaminase IgA antibodies (N = 132), anti-endomysium antibodies (N = 25), and anti-deamidated gliadin antibodies (N = 23). Additionally, histological parameters were assessed in 142 patients, focusing on the analysis of villous atrophy.

After entering the data into Excel, the SPSS Statistics 26 free trial software was used to analyze the data. The results were expressed in percentages, and the statistical analyses of the data consisted of an analysis of variance (ANOVA) and the least significant difference (LSD) test. Furthermore, a correlation test was performed between the serological tests and the histological profile.

Results

The prevalence of CD was determined as the proportion of affected individuals in the population at a given time. The prevalence of CD based on the identification of clinical history, serological positivity, and duodenal biopsy. With 3,791,551 inhabitants of the TTA region (2018–2021) as the population and 280 patients as the sample, it suggests that every one person represent 135 individuals in the population.

The incidence represented the number of new cases reported per year. There were 150 new cases diagnosed during this period (2018–2021) suggesting that every one person represent 253 individuals in the population. The results showed that 68% of the patients were female, while males represented only 32%. The females were the most affected by CD, with a male/female sex ratio of 0.45.

The mean age of the CD patients was 21.18±1.13

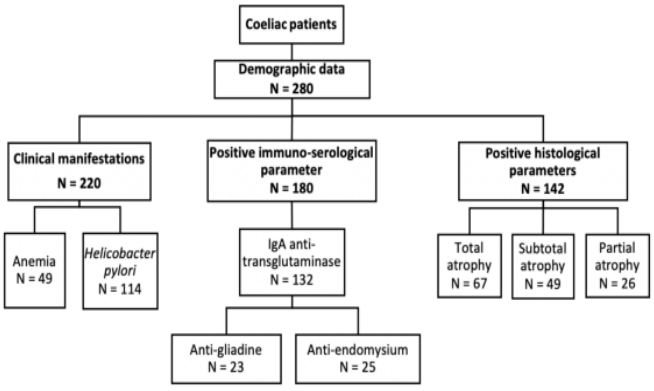
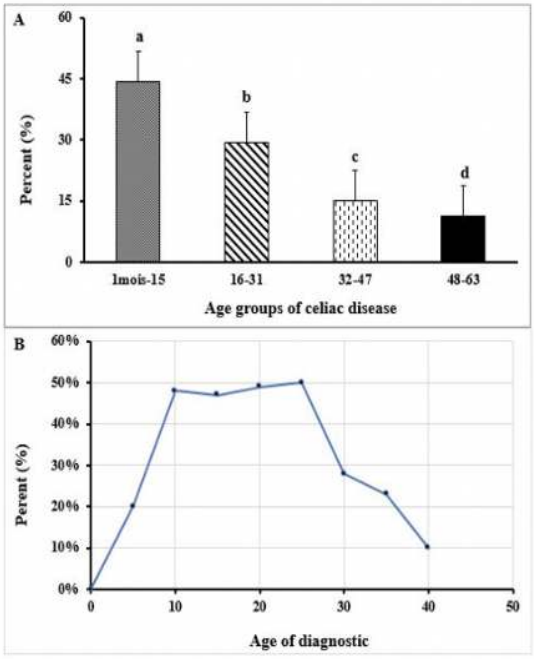


Figure 1. Data of the Analyzed Parameter



Note: *Bans with different letters represent significantly different values according to Tukey's test (p-value≤0.05).

Figure 2. The Age Distribution

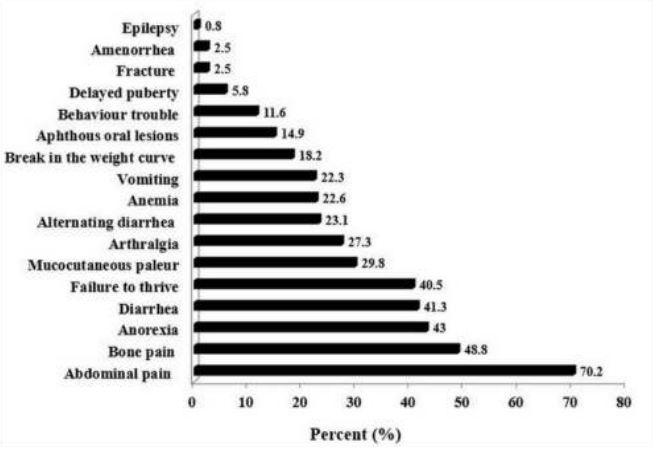
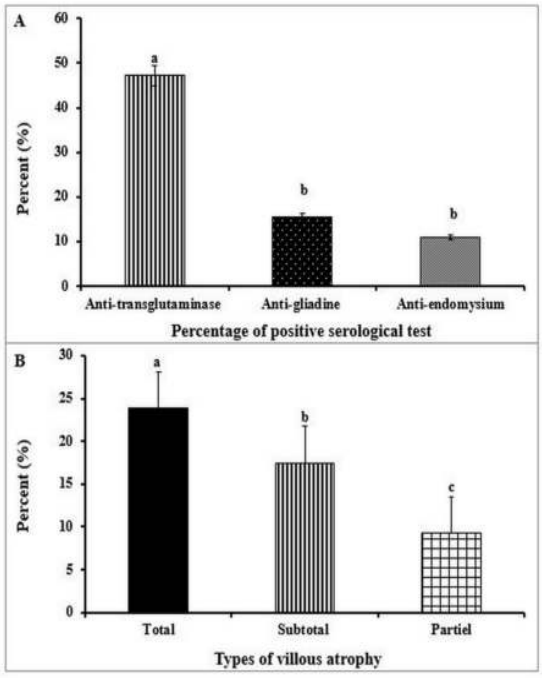


Figure 3. Clinical Characteristics of Celiac Disease



Note: *Bans with different letters represent significantly different values according to Tukey's test (p-value≤0.05).

Figure 4. Serological Tests and Types of Villous Atrophy

years, with the minimum and maximum ranging from one month to 63 years. Figure 2A shows that the age group of one month to 15 years is the modal class, which encompasses the biggest percentage of patients at 44.3%, followed by the adult population at 29.3%. The population aged 32–47 years represented 15% of the total number, and, lastly, the population range of 48–63 years had the lowest representation, with a mere 11.4%. It can be concluded that the population sample has different age groups: children, adolescents, adults, and older people. Figure 2B shows that CD could appear at birth and increase until aged 10 years when it reaches its peak. It showed a plateau between 10 and 25 years, when it started declining.

Figure 3 shows that the main signs that revealed CD in patients were mainly digestive—notably, abdominal bloating (70.2%), followed by anorexia (43%), diarrhea (41.3%), alternating diarrhea (23.1%), and vomiting (22.3%). The signs of non-gastrointestinal symptoms were manifested by a failure to thrive (40.5%), a break in the weight curve (18.2%), as well as microcytic hypochromic anemia (22.2%), bone pain (48.8%), arthralgia (27.3%), and fracture (2.5%). The physical signs present in the patients were characterized by mucocutaneous pallor (29.8%) and oral aphthosis (14.9%). Moreover, *Helicobacter pylori* (HP) infection was noted in 40.7% of the patients. Other manifestations were observed: the reproductive disorders of puberty delay (5.8%) and amenorrhea (2.5%) and the neurological disorders of behavioral disorders (11.6%).

The CD is frequently associated with other pathologies. Therefore, screening for these other conditions is necessary to diagnose CD. The main pathologies were associated with CD in this study. The results revealed that 6.77% of the CD patients (n = 19) had associated diseases, including six recurrent spontaneous abortions (2.14%), four cases of T1DM (1.42%), four cases of autism (1.42%), two cases of dermatitis herpetiformis (0.72%), two cases of cancer (0.72%), and one case of epilepsy (0.35%). During the study period, there were two mortality cases due to small bowel cancer.

The results of the serological analyses were collected from the patients' files classified as CD (Figure 4A). It was noted that the anti-transglutaminase antibodies (47.2%) were the most present in the blood of the patients, which gave them the highest concentration compared to the anti-gliadin antibodies (6.42%) and anti-endomysium antibodies (6.78%). After analyzing the graph results, significant differences were observed between the different serological tests: anti-gliadin decreased significantly compared to anti-transglutaminase by 13.6%. Analysis of the histological findings showed that 50.8% of patients had villous atrophy. Figure 4B shows the different types of atrophy: 24% of the patients have total villous atrophy, 17.5% have subtotal villous atrophy, and 9.3% have only partial villous atrophy.

Discussion

The prevalence of CD in this study was 1/135, which was close to the prevalence results of Portugal (1/134)

and Switzerland (1/132).[18] The prevalence of CD is estimated to range from 0.10% to 3.03% in Europe,[19] but it is not widespread in Asia.[20] The prevalence is the highest in Oceania (0.8%),[21] while biopsy-confirmed CD was found to be 1.9% in South Africa.[22] The incidence rate for Americans is 1/133.[23] The increase in prevalence in recent years can be attributed partly to improved diagnostic techniques and increased disease awareness.[24]

The incidence of CD in this study was 1/253. During the three years of study, an increasing disease risk occurred because the association received more than two to three cases weekly. The study by Lebwohl, *et al*., confirms that the incidence of CD increases with global distribution.[25] This increase in incidence was probably related to the main factors of a better knowledge of asymptomatic forms and a significant change in diet habits, particularly in the consumption of gluten and in the feeding patterns of infants. The members of the GIAAN medical committee were unanimous: there was no increased risk of COVID-19 for CD patients.

The study population included patients of different ages: children, adolescents, adults, and older people, with an average age of 21.18±1.13 years. This study's results were similar to Rekik's, which involved an average age of 28.2 years.[26] In contrast, Dinler, *et al.*, examined a population with a mean age of 8.2 years.[14] While, Tortora, *et al.*, found that 2.5% of older people were 65 years or older at the time of diagnosis.[28] This implies that CD is a disease that can affect any age. Like COVID-19, children are asymptomatic, but older people are the most vulnerable to CD and present serious complications.[27]

Additionally, the peak age for the onset of CD is observed in adolescence and adulthood (10–25 years). This result could be explained by the fact that the diet at this age was based on foods containing gluten, such as bread, biscuits, and pizza, as well as the excessive consumption of industrial products. Women comprised 68% of the patients in this age group, while men comprised only 32%. Another study also found this predominance, showing that CD is two to three times more common in women than men.[28] This predominance could be due to the influence of female hormones or the predisposition to CD being higher in women than men. Likewise, COVID-19 affected more females with CD than males with CD.[27]

The diagnosis of CD is based on a combination of clinical, serological, and histological criteria. However, histology remains the essential reference examination for confirming the diagnosis of CD before starting a GFD.[7] Given the importance of CD in incidence and the consequent delay in diagnosis, it is also useful to carry out the clinical part. In this study, the most dominant clinical manifestations of CD were gastrointestinal signs. Clinically, the table is highly variable.[8] Difficulties in the delay in diagnosis of refractory celiac were consistent with CD.[29] The CD can appear at any age with a wide range of clinical manifestations, which may be atypical in many cases and may remain more or less "silent" for years while continuing to destroy the intestine and other organs.[29] The spectrum of symptoms of the disease is broad, including both gastrointestinal and non-gastrointestinal symptoms.[30] The chemokine profile found in COVID-19 at the intestinal level closely resembles the immunological response to CD and intestinal bacterial translocation.[2]

HP infection and microcytic hypochromic anemia were common in this study. These results were because the diet of celiac patients contains less fiber and flavonoids, which leads to the appearance of anemia. The HP was an opportunistic bacterium present in the normal flora of an individual. However, it became pathogenic due to the weakening of the body's defenses and was diagnosed in over 40% of patients. This condition was comparable to the study by Nour, *et al*., that found a 41.6% prevalence of HP.[31] In this context, the search for HP and anemia should be systematic.

This study found several pathological associations with CD. In previous studies, other diseases have been reported in celiac patients, such as selective IgA deficiency, autoimmune thyroiditis, and primary biliary cirrhosis.[9] Malignant complications in CD are rare but serious.[32] T-cell lymphoma and refractory sprue are frequently associated with significant morbidity and mortality.[7] However, Prucher, *et al.*, show that most patients have undergone diagnostic tests for SARS-CoV-2 following complications.[33]

High levels of IgA antibodies were found in patients who had done the test without taking anti-deamidated gliadin peptide (DPG) or anti-endomysial antibody (EMA) tests because testing for these antibodies is more expensive. This condition explained the low rate obtained from these tests. Gozalbo, *et al.*, agree concerning the high prevalence of the Saharawi population, as wheat flour is the staple food of their diet.[34]

DPG antibody tests were only performed in 23 patients. The results were positive in 6.42% of patients. Of the 25 patients tested for EMA, 6.78% were positive. Due to the small number of patients who were tested, this rate was most likely underestimated. More accurate sampling analysis, including DPG and EMA, can improve the immunoserological profile in CD patients. The performance features of the most recent serological assays specific to celiac disease are among the finest.[35] In fact, detecting EMA antibodies is the most specific biological parameter for detecting CD.[36] According to the recommendations of the European Society of Gastroenterology and Paediatrics, IgA transglutaminase antibodies should be used as an initial test, regardless of the children's age.[37] Other studies confirm that IgA is a helpful indicator of CD and ought to be used as the first test for it.[38]

Histological analysis of intestinal biopsies was positive in 50.8% of cases. The biopsy is not systematically performed in all children because of the risks associated with general anesthesia.[9] A biopsy was specially prescribed in atypical forms, such as in cases of high tTGA levels. Therefore, diagnosing villous atrophy is necessary for diagnosing CD and following the GFD evolution. According to the statistical analysis, there was a minor correlation between the serological profile and the degree of atrophy (p-value = 0.361); therefore, it was not statistically significant. In addition, the population did not correlate with the serological tests.

The only treatment currently available is the GFD. However, the difficulties encountered were in part related to a lack of confidence in finding safe gluten-free food.[39] Gluten is present in various products. A GFD should lead to a remission of the symptoms, as there is no current drug treatment. This study underlined the role of the GIAAN in promoting awareness, orientation, and social support for gluten-free products for the benefit of people in poverty. Also, Morocco will soon implement subsidized gluten-free products for people with histological confirmation of villous atrophy.

Conclusion

This study in Morocco explores the demographic, serological, and histological characteristics of CD, revealing similarities to other countries. The CD predominantly affects adult females, and tTGA antibodies are commonly used for screening, although histology remains the definitive diagnostic method. Given the disease's multiple manifestations, diagnosis can be challenging. Expanding the study's sample to other research centers is recommended to validate the results on a broader scale. The study highlights the importance of early detection and multidisciplinary collaboration in patient care, as well as the need for awareness programs and strategies to improve the lives of CD patients, especially considering the economic and social challenges faced in the region. However, limitations such as limited awareness and COVID-19 restrictions were noted, emphasizing the necessity for further efforts in screening and patient support.

Abbreviations

CD: Celiac Disease; GFD: Gluten-Free Diet; T1DM: Type 1 Diabetes mellitus; TTA: Tangier-Tetouan-Al Hoceima; GIAAN: the Association of Gluten Intolerant and Allergic of the North; HP: *Helicobacter pylori*.; DPG: Deamidated Gliadin Peptide; EMA: Endomysial Antibody; TGA: Transglutaminase.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The author stated no substantial competing financial, professional, or personal interests that could have influenced how the work described in this publication was performed or presented.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article.

Authors' Contribution

HM and YB collected the data, conceived the study, designed the analysis, contributed data, writing the paper. IM corrected the article, orientation toward the clinical part. AD and AK were responsible for the graphs and statistics. HE and SB were done the proofreading, following up on the fieldwork, and the corrections to the article.

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Nutrition Education Effect on Anemia Incidence in Female Adolescents: Meta-Analysis for Future Health Post-COVID-19 Pandemic

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Abstract

Female adolescents are at a heightened risk of anemia due to inadequate iron intake and absorption, blood loss during menstruation, and an escalated need for iron to support rapid growth. This study examined the impact of nutrition education on the incidence of anemia in adolescent girls. The investigation was conducted through a systematic review and meta-analysis, employing articles from reputable sources such as Google Scholar, JAMA Network, PubMed, ScienceDirect, The New England Journal of Medicine, Lancet, and ProQuest, published between 2013 and 2021. The keywords for data retrieval were "nutrition education" and "adolescent anemia girls." Furthermore, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline was used to select and organize publications for this study. Using Review Manager 5.3 Software, full-text articles meeting meta-analysis criteria were selected, resulting in 7 out of the 257 retrieved articles being included. The findings suggested that nutrition education indeed impacts the incidence of anemia in adolescent girls (p-value<0.001; aOR = 2.10; 95% CI = 1.60-2.76).

Keywords: adolescents, anemia, health promotion, meta-analysis, nutrition education

Introduction

Anemia is a sign of poor health in terms of nutrition and it is a condition with a decrease in hemoglobin levels below the normal value caused by iron deficiency.[1] Anemia and malnutrition remain global health issues, accounting for 1.6 billion people or 25% of the world's population, especially among women in developing countries, including Indonesia.[1-3] The World Health Organization defines adolescents as aged 10-19 years.[4-6] Adolescent girls have an excessive chance of developing anemia due to low iron consumption and absorption, blood loss during menstruation, and an accelerated need for iron to support fast growth.[7]

In developing countries, anemia affects a huge wide variety of people.[8,9] An observation conducted in 34 African countries discovered that the estimated prevalence in adolescents and younger women ranged from 15% to more than 50%.[10] During the El Nino event in 2015/2016, the cost of meals in Woldia City experienced a significant surge due to a considerable decline in crop production in the surrounding district.[11] This condition is one of the causes of food shortages in this region and can impact family food availability. The availability of family food can profoundly impact family food intake, leading to inadequate individual intake of essential nutrients, such as protein, as well as micronutrients like iron, vitamin B12, and other vital elements crucial for preventing anemia.[12]

In India, the problem of malnutrition and micronutrient deficiencies is a huge spread.[13] Micronutrient deficiencies during early childhood can frequently change in adolescents with long-term effects on health, cognition, education, and productivity.[13] Several studies have been undertaken to address anemia prevention, encompassing young women and focusing on the well-being of toddlers, small children, pregnant women, and lactating women.[14-16]

The cause of the current increase in anemia rates is the coronavirus disease 2019 (COVID-19) pandemic. This condition has led to significant social transformations affecting overall health status, including anemia, and the feasibility of implementing health programs sustainably. The transmission of COVID-19 has a detrimental effect on individuals, primarily manifested through the loss of income, which includes factors such as job loss, unemployment, or layoffs.[17]

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This pandemic increases the risk of anemia among female adolescents and pregnant women due to irregular consumption of blood-boosting tablets and weakened economic conditions, reducing nutritional intake.[14] Female adolescents and pregnant women from low-income families are especially vulnerable to reduced access to healthy food, increased food insecurity, long-term uncertainty in finding work, and reduced physical activity.[14]

Other studies have shown that nutrition education can enhance adolescents' knowledge, leading to changes in their thinking and an increased awareness of how to prevent anemia.[18] This is achieved through the effective dissemination of nutritional education to adolescents.[18] Education is an important part of human resources and the most important part of human life. In today's education era, technological development encourages the importance or role of education in the nation's life.[15,16] Education also has several factors that can influence human knowledge, such as the learning strategy or medium used.[19,20]

Even though many similar primary studies have been conducted, some inconsistent study results remain. Therefore, a comprehensive analysis is needed to obtain a result that can be interpreted as a whole.[21] This study aimed to analyze the effect of nutrient education on anemia, especially in adolescent girls, to attain convincing and concerning results. It was conducted as a follow-up to conclude the impact of nutrition education on anemia and determine whether health programs can reduce the incidence in adolescent girls.

Method

A total of six writers carried out a systematic literature review of one and five primary and co-authors from March to early May 2021. This study collected the articles from Google Scholar, JAMA Network, PubMed, ScienceDirect, The New England of Medicine, Lancet, and the ProQuest website. These seven databases were selected as well-known health databases with bibliometrics, providing free and easy access to verify other people's work.

The first step was to access the database's website, identify relevant articles, and input keywords indicating study material into the website search engine. On PubMed, Google Scholar, Lancet, JAMA Network, The New England of Medicine, and ProQuest website, the text availability articles (full text and free full text), article types (journal), with the publication of the last nine years (2013–2021) were ticked. For ScienceDirect, after going to the website, all categories for the publication title, as well as subject areas, were ticked by defining the article type as study papers.

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline, the next step included: 1) Identifying: the authors used quotation marks or apostrophes to designate relevant journal article titles in the search box on the seven website addresses for this study. The boolean symbol "AND" was used between keywords with two or more of them. The keywords used to determine the articles related to Get Nutrition Education (as an exposure) and Anemia (as an outcome) are: "Nutrition education" and "girls' adolescent's anemia" and aOR, "nutrition education" AND "Anemia" AND "adolescents girls" OR "adolescents" OR "young children" AND aOR. Furthermore, the articles that surfaced repeatedly during keyword searches were not reused.

2) Screening: the authors selected an article title corresponding to the theme while screening journal article titles. The inclusion criteria (full-text, open-access articles, adolescents, young girls, and girls' adolescents) were applied to all abstract identifications, which were read and reviewed. Original publications discussing nutrition education and anemia disease met the criteria for inclusion. The study's method was quantitative, and the interviews were performed in person and written in English. While, articles with abstracts that did not match the requirements were discarded.

3) Eligibility: full-text versions of selected publications that match the inclusion criteria were downloaded. Open-access and closed-access journals must also meet the criteria. To obtain a link between nutrition education and anemia, the journals were reviewed and selected. 4) Included: all journal articles that meet the inclusion criteria were sorted by publication year, study location, design, duration, sample size, number of respondents, and adjusted Odd Ratio (aOR) values. This data was required to compute meta-analysis using Review Manager 5.3 Software, an open-source software known as "Review Manager 5 Software".[22] Furthermore, the articles that were not discovered had their OR values removed.

Meta-analysis was calculated in the final stage by displaying the three components: 1) figure of heterogeneity (I-squared (I2)) to determine whether the data in the selected journals were homogeneous or heterogeneous, 2) examining the publication bias figure (Funnel Plot) to prevent publication bias, and 3) analyzing effect size figure (Forest Plot) to obtain effect in getting nutrition education with anemia in adolescents girls.[4,5]

Results

The procedure of identifying suitable articles for meta-analysis evaluating the influence of nutrition education on the incidence of anemia in female adolescents is depicted in Figure 1. After searching seven databases, 257 articles were reported, and only seven were qualified for the study. The features of the eligible article for the

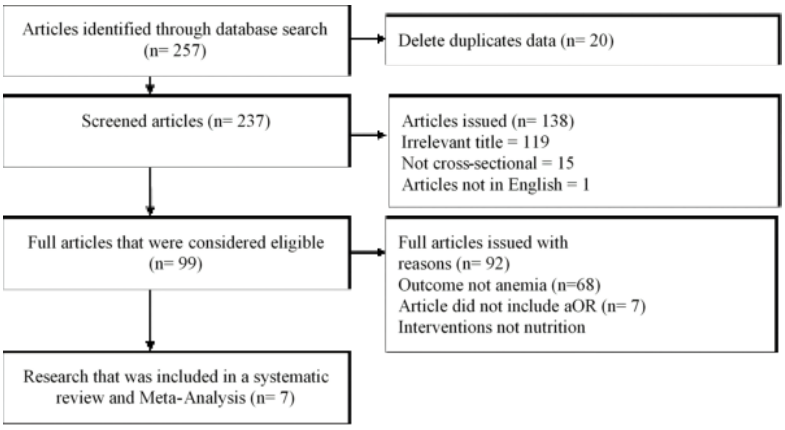

Figure 1. PRISMA Guidelines Flowchart

Table 1. Eligible Articles Characteristics

Author (Year)	Country	Study Design	Period	Sample Size	Respondent (Age)	Intervention	Outcome	aOR
Agustina, *et al.*[23] (2020)	Indonesia	Cross-sectional	2016	340	Adolescent girls (12-19)	Frequency of reading newspapers or listening to radio	Blood hemoglobin concentration	1.44
Alemu, *et al.*[24] (2019)	Ethiopia	Cross-sectional	2011	406	Adolescent girls (10-19)	Knowledge score	Blood hemoglobin concentration	1.15
Bansal, *et al.*[25] (2020)	India	Cross-sectional	2015-2018	5,897	Adolescent girls (10-19)	Media exposure of adolescents	Minimum dietary diversity (MDD-W) for women and blood hemoglobin concentration	
Endalifer, *et al.*[26] (2021)	Ethiopia Northeast	Cross-sectional	2016	411	Adolescent girls (11-12)	Knowledge about nutrition	Dietary Diversity Score (DDS) and Hb Level	4.56
Gebreyesus, *et al.*[27] (2019)	Ethiopia	Cross-sectional	2015	1,323	Adolescent girls (10-14)	Knowing the term "anemia	Hemoglobin Level	1.58
Handiso, *et al.*[28] (2020)	Ethiopia Southern	Cross-sectional	2019	843	Adolescent girls (10-19)	Taking nutrition education	24-h dietary recall (24 HR) and Hb Level	2.20
Shemelise, *et al.*[29] (2020)	Ethiopia	Cross-sectional	2008-2009	5,500	Secondary Data (15-49)	Illiterate	Hemoglobin Level	2.69

Note: aOR = adjusted Odd Ratio

systematic review are shown in Table 1. The majority of the study location were in industrialized countries such as Southern Ethiopia, Northeast Ethiopia, India, and Indonesia.[23-29] The studies used a cross-sectional design with data from 2013 and 2021.

Table 1 shows that nutrition education is a predictor of anemia in female adolescents in all of the seven articles. The sample sizes in all articles were large; the lowest number of respondents was 340, while the highest was 5,897. The age groups were divided into 10-19 and 15-49 years, and Table 2 lists all eligible articles.

The aOR values of the seven selected articles are shown in Figure 2. According to a meta-analysis conducted with RevMan 5.3 Software free version, the random effect analysis showed the estimated amount of total heterogeneity using I Squared (I2) of 57% with a p-value of <0.001. Figure 2 shows the forest plot, where female adolescents who did not receive education/information on nutrition increased the incidence of anemia by 2.10 times with a statistically significant effect (p-value<0.001). Heterogeneity (I2) = 57% indicated the distribution of heterogeneous facts (random effect model).

Figure 3 shows a symmetrical shape in the graph, with 2 and 3 plots on the right and left, indicating a publication bias. The standard error on the left and right plots was 0.8 to 0.2 and 0.5 to 0.3. While, the disproportionate distance between studies in both the right and left plots caused bias.

Discussion

Anemia causes a decrease in the ability to carry oxygen, making the body tired quickly and weak. The cause of anemia in adolescent girls includes menstruation, severe bleeding, nutritional deficiencies (iron, folate, pro-

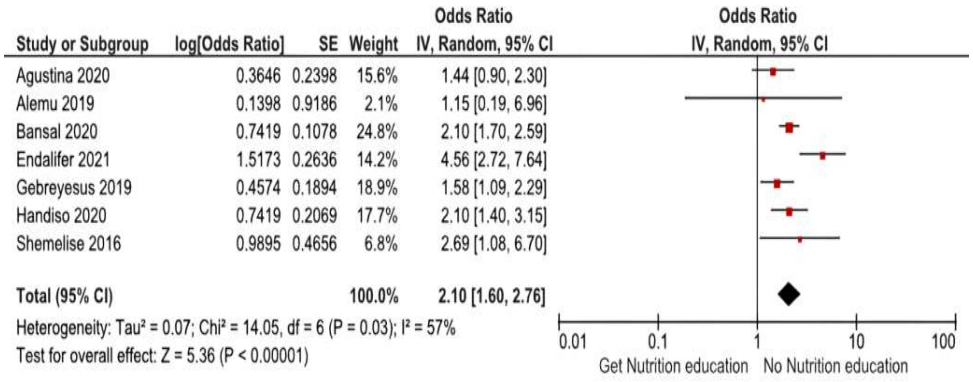

Figure 2. Forest Plot Between Nutrition Education on the Incidence of Anemia in Female Adolescents

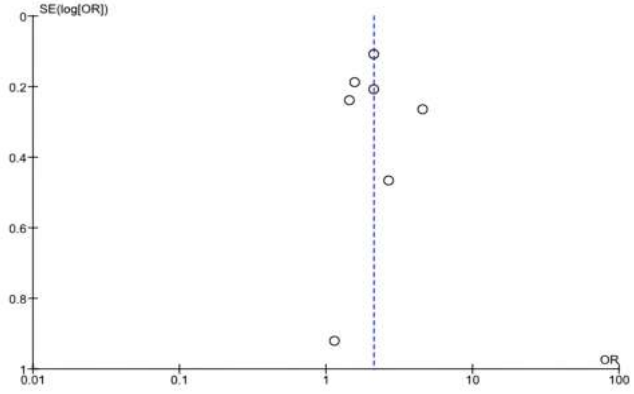

Figure 3. Funnel Plot Between Nutrition Education on the Incidence of Anemia in Female Adolescents

tein), leukemia, and chronic disease.[30] In addition, COVID-19 is considered a causative factor due to its ability to assail the respiratory system, resulting in a reduction of hemoglobin and red blood cells responsible for oxygen transportation across the body.[14] Anemia signs include weakness, fatigue, lethargy, lack of enthusiasm in daily activities, and tightness.[21]

Female adolescents from families whose moms had no formal schooling were 3.2 instances more likely to attain low food variety.[31] While, individuals from families whose fathers only finished grades 1 to 4 were 2.6 times more likely to attain low food variety than those whose fathers finished college.[32] Awareness and knowledge can decorate food preferences and eating behavior.[33] Similarly, this knowledgeable family has a better economic status resulting in an excessive quality food plan.[34] Comparable findings were also reported by studies performed in Iran, Nigeria, Northern Ethiopia, and Gurage.[31,33,34]

The absence of nutrient education was significantly associated with lower nutritional range scores among female adolescents in Southern Ethiopia.[35] Female adolescents who did not attend nutrient education were 2.1 times more likely to have a low food variety score in assessment.[36] Decision-making strength for nutrition services was statistically associated with the dietary variety scores of observed individuals.[37] Furthermore, those with single fathers and mothers became 2.2 and 2.0 times more likely to have low dietary variety scores than those with both. Elevating the level of awareness of nutrition increased the food variety score, and these findings were in line with studies in Ethiopia.[37]

Other studies showed that adolescents with bad dietary knowledge were genuinely related to inadequate nutrient variety. Rahmiwati, *et al.*, showed that nutrition education is the correct, effective, and sustainable method to prevent iron deficiency anemia.[21] Jeihooni, *et al.*, also supported the importance of nutrition education to prevent anemia. The study was conducted on 160 students in Fasa City, Fars Province, Iran, from 2018-2019. Education programs must be implemented with a suitable and active education model to enhance the health of adolescent girls, particularly in preventing anemia.[38]

Another study stated that significant nutrition education intervention increased the knowledge score by 28.6, and there were differences in the level of knowledge after anemia nutrition education intervention was carried out in both groups.[39] The results were consistent with studies conducted in Luxembourg and Jimma, which used the increasing knowledge of adolescent girls regarding diseases.[40] The evidence showed that adolescents with this knowledge consumed more diverse foods.[40] Future studies are encouraged by including indexing databases and seeking out articles with a different publication year range in more than two languages (English and Indonesian Language). This method aims to enhance the comprehensiveness and inclusivity of the study find-

ings.

Conclusion

Anemia in female adolescents was an indicator of nutritional status. The cause included menstruation, severe bleeding, nutritional deficiencies (iron, folate, protein), leukemia, and chronic disease. This meta-analysis showed that nutrition education affected the risk of anemia in adolescent girls divided into two groups of 10-19 and 15-49 years. Therefore, as a policymaker, the government should pay close attention to the importance of nutrition education for young women to raise nutrition knowledge and avoid anemia.

Abbreviations

COVID-19: coronavirus disease 2019; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis; aOR: Adjusted Odds Ratio.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The author stated no substantial competing financial, professional, or personal interests that could have influenced how the work described in this publication was performed or presented.

Availability of Data and Materials

The data is publicly available from Google Scholar, JAMA Network, PubMed, ScienceDirect, The New England of Medicine, Lancet, and ProQuest databases published from 2013-2021. For more information, the reader can contact the corresponding author.

Authors' Contribution

AR contributed to the manuscript's conceptualization, data screening, supervision, and writing. The manuscript was conceived and written with the help of KD, TK, DMU, RD, and FU.

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Kesmas: Jurnal Kesehatan Masyarakat Nasional (Kesmas: National Public Health Journal)

The Climate Effect on COVID-19: Lessons Learned from the Pandemic in Jakarta

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Abstract

The global COVID-19 pandemic has presented humanity with difficult and unforeseeable hurdles. Among these challenges is understanding how climate-related aspects impact the survival of the SARS-CoV-2 virus. This study aimed to investigate the relationship between environmental factors, such as temperature, humidity, and rainfall, and the spread of COVID-19 cases in different regions. A time-and-place-based ecological study design was adopted, integrating geographic information systems and statistical techniques. Statistical testing revealed a significant association between humidity (p-value = 0.000; r = -0.777) and rainfall (p-value = 0.001; r = -0.561) with COVID-19 instances. However, no statistically significant relationship was found between temperature variables and COVID-19 cases. Due to the impact of changing weather conditions, governments may become concerned about developing tailored preventive and control measures, considering the varying risk levels associated with different locations.

Keywords: climate, COVID-19, spatial-temporal analysis

Introduction

Climate influences health through a variety of direct and indirect mechanisms.[1] Extreme weather, for example, can cause direct mortality from heatwaves, as well as leading to disturbed food systems, increased zoonoses, and food-, water-, and vector-borne diseases.[2] The indirect social and economic consequences of climate and weather shocks can drive households into poverty, a major determinant of poor health.[1] Epidemics, like weather and climate, know no boundaries and can endanger human health and societal stability. From the time when the coronavirus appeared in 2003 to the H1N1 outbreak in 2009, followed by the Ebola virus in West Africa in 2014, the Zika virus in the Americas in 2015, and most recently, the severe acute respiratory system coronavirus 2 (SARS-CoV-2) outbreak in China in 2019, they showed how rapidly infectious diseases can spread, causing severe consequences.[3,4] The emergence of these new illnesses is most noticeable in vulnerable societies, such as those with fast urbanizing areas, weaker health systems, underserved populations experiencing rising income inequalities, and severe social, ecological, and climatic changes.[1,2]

The coronavirus disease 2019 (COVID-19) pandemic has presented humanity with difficult and uncertain situations.[5] One aspect of these challenges revolves around the influence of climate-related elements, such as air temperature, humidity, and rainfall, on the survival of the SARS-CoV-2.[6-9] Several studies conducted globally have shown that climatic factors play a role in the occurrence of COVID-19 cases. One notable study conducted by Sobral, *et al.*, encompassing all countries impacted by COVID-19, revealed a link between temperature and the prevalence of SARS-CoV-2 infections.[9] It found that as average temperature decreased, the number of cases of SARS-CoV-2 infection tended to increase. Additionally, the study indicated a positive relationship between precipitation and the transmission of SARS-CoV-2.[9] Liu, *et al.*, explored the connection between absolute humidity and the quantity of COVID-19 cases in 30 provincial capitals in China.10 They found that meteorological factors, particularly absolute humidity, independently contribute to the transmission of COVID-19. The study suggested that lower temperatures, small temperature fluctuations throughout the day, and lower humidity levels facilitate the virus's spread.[10] According to Chen, *et al.*, wind speed, temperature, and relative humidity are influential factors in determining the extent of COVID-19 transmis-

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sion.[11]

This climate-related matter raises concerns among policymakers, particularly regarding the potential effects of climate variability and change on the well-being of marginalized and vulnerable communities. These communities include children, the elderly, women, low-income individuals, ethnic minorities, migrants or refugees, and those with underlying health conditions.[1,2] If the climate issues are not managed effectively, similar challenges will happen in the future.[5] This study employed a spatial and temporal approach to examine the connection between climate and COVID-19 cases. It aimed to provide valuable insights into the role of climate in COVID-19, which policymakers can utilize to develop mitigation strategies once the pandemic is over.

Method

Using an ecological design that allowed for real-time and location-based analysis through geographic information systems, a quantitative study approach was utilized. Statistical techniques were employed to test the collected data. The study population consisted of weekly COVID-19 case data recorded at the Special Capital Region of Jakarta Provincial Health Office from March to September 2020. In this study, the entire population was included in the sample (total sampling). The secondary data used encompassed daily reports of COVID-19 cases as well as climate variables, such as maximum, minimum, and average temperature, humidity, and rainfall in Jakarta from March to September 2020.

The data for this study were acquired from two websites: the Jakarta Provincial Health Office (https://corona.jakarta.go.id/id/data-pemantauan)[12] and the Indonesian Meteorological, Climatological, and Geophysical Agency (https://dataonline.bmkg.go.id/akses_data).[13] The collected information was compiled into a dataset spanning 31 weeks. This consolidation was done considering various factors, including the COVID-19 incubation period (5–6 days) and the uncertain time gap between the initial infection day and the sampling day.[14] Moreover, a basic map of Jakarta, delineating the boundaries of urban villages, was acquired from the GADM Map and Data site (https://gadm.org/maps/IDN/jakartaraya.html).[15] The coordinates for the weather monitoring stations were obtained online from https://www.gps-latitude-longitude.com/.[16] This study was conducted within the Jakarta province, which encompasses 261 urban villages.

To examine the distribution of various variables, including minimum, maximum, and average temperature (oC), humidity (%), rainfall (mm), and the number of COVID-19 cases, univariate analysis was employed. This descriptive and quantitative method involved presenting data through statistical distribution tables, line graphs, and thematic maps, aligning with the study objectives. Additionally, Pearson's product-moment correlation test was utilized to analyze the relationship between climate factors and COVID-19. The technique used in this study specifically assessed the likelihood of a relationship's existence (p-value<0.05), closeness (r), and direction.

Furthermore, the strength of the associations was qualitatively categorized into four groups: absence/weak relationship (r = 0.00–0.25), moderate relationship (r = 0.26–0.50), strong relationship (r = 0.51–0.75), and very strong/perfect relationship (r = 0.76–1.00).17 The correlation value also indicated whether the relationship was positive or negative. The value (r) was used to evaluate the relationship, with r = 0 indicating no linear relationship, r = −1 representing perfect negative linearity, and r = 1 representing perfect positive linearity.[17] Furthermore, both univariate and bivariate analyses were conducted in the Faculty of Public Health Universitas Indonesia computer laboratory using SPSS 21.

To examine the relationship between the variables, spatial analysis was employed. An interpolation technique was utilized to create a combined map illustrating the occurrences of COVID-19 cases and climate factors within a specified community. The following steps were taken to estimate climate variables beyond the measurement locations (weather stations) using the Jakarta grid map interpolation: First, a grid map consisting of five weather monitoring stations was generated. The specific values or attributes of the points, such as longitude and latitude, were interpolated by integrating them into the attribute table of the climate variable data. These coordinate points were then merged onto the climate variable map.

Additionally, the vector data representing the independent variables were digitized by inputting the geographic data related to climate variables onto a base map. The subsequent step involved processing and selecting a color symbol (using a single-band pseudo-color) with a range of red hues. Consequently, the data size led to the creation of a digital classification system for climate variables that distinguished between high and low values. Subsequently, considering the specific community, the vector data representing the dependent variable were digitized by integrating spatial data on COVID-19 rates into the base map. This involved data processing and selecting a point symbol (centroid) to represent the locations. A digital classification system for COVID-19 cases was also established, categorizing them as major or minor based on the illness data.

Next, the interpolation option within the plugin was employed to interpolate the two vector maps. This process resulted in creating an interpolated raster plot, which was then utilized to examine or predict the values of the climate variables in each urban village. The result-

ing color gradients and point symbols did not convey specific ratios. Instead, they represented ordinal numbers, such as the fluctuation of climate variables from high to low and the counts of viral cases. The digital representation of colors was achieved using the QGIS software, employing a single-band pseudo-color with a range of red hues. The colors were grouped into five classes, with very dark red indicating very high values, dark red indicating high values, red indicating medium values, light red indicating low values, and white indicating very low values.

To depict the spread of the virus, dot symbols (centroids) were utilized, varying in size from large to small. Likewise, the size of the point symbols was digitally determined using either a basic marker or a standard symbol from the QGIS software, adopting a linear classification scale ranging from 0 to 17. The spatially analyzed data were utilized to generate thematic graphics and maps that displayed the time–location relationship patterns. This spatial analysis was conducted in conjunction with the statistical correlation results using QGIS 3.0 in the Faculty of Public Health Universitas Indonesia computer laboratory.

Results

Analysis of the relationship between humidity and COVID-19 cases in Jakarta showed a significant correlation, with a strong level of closeness and a negative trend, meaning that when humidity levels were lower, the like-

Table 1. Correlation Test Between Climate Variables and COVID-19 Cases

Variable	COVID-19 Case	
	p-value	r
Minimum temperature	0.200	0.237
Maximum temperature	0.076	0.324
Average temperature	0.280	0.200
Humidity	0.000	-0.777
Rainfall	0.001	-0.561

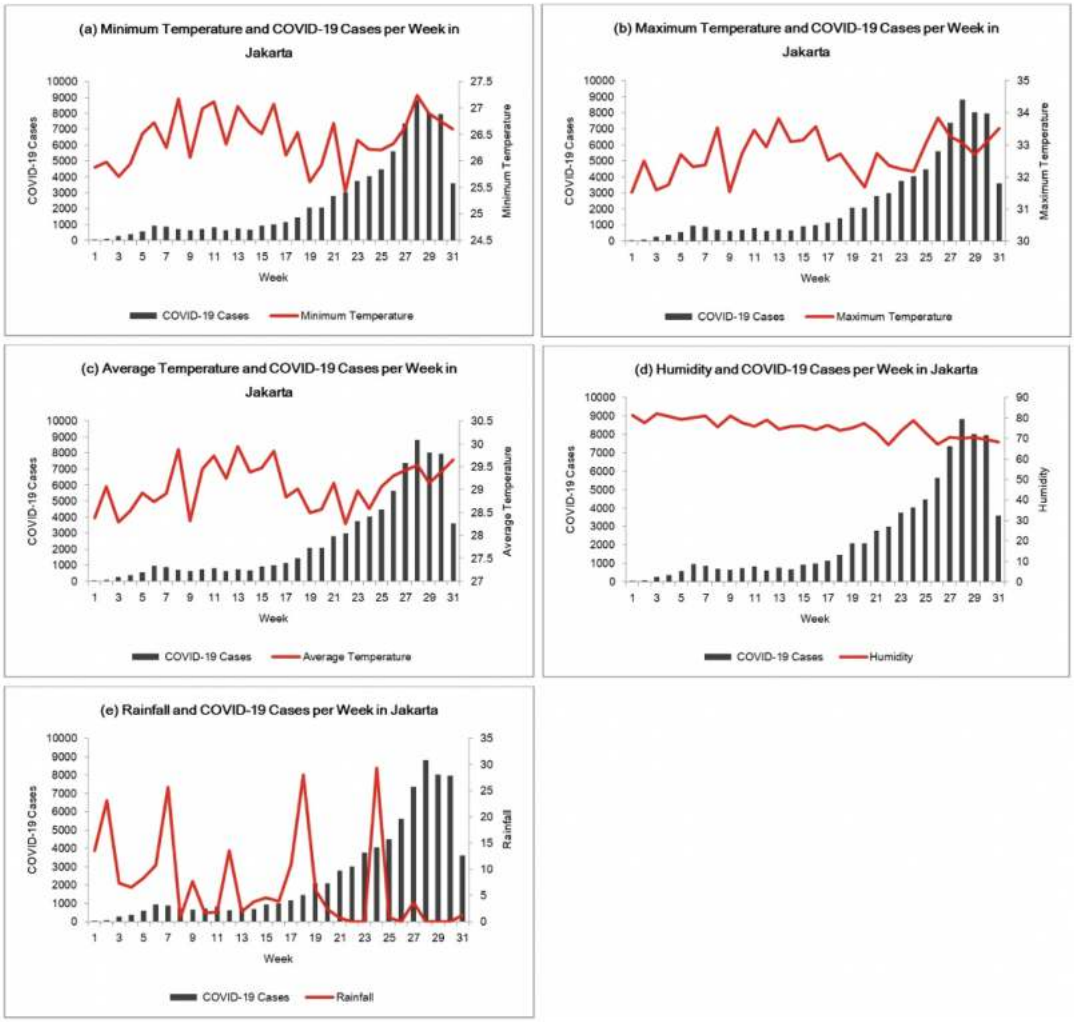

Figure 1. Climate Patterns and COVID-19 Cases

lihood of COVID-19 cases would be higher, and vice versa. Similarly, the correlation test between rainfall and COVID-19 data in Jakarta showed a significant relationship, with a strong level of closeness and a negative pattern. These results suggested that an increase in rainfall could potentially lead to a decrease in COVID-19 cases (Table 1).

In the weekly graph (Figure 1), the weather pattern shows similarities with the monthly pattern. The minimum, maximum, and average temperatures showed similar trends to the COVID-19 cases, while the humidity and precipitation variables showed opposite trends to the COVID-19 cases.

The spatial representation of humidity and COVID-19 cases revealed that urban villages with lower humidity levels experienced an earlier increase in cases than those with higher humidity. In July, there was a notable spike in cases, particularly in West Cempaka Putih (114 cases), Lagoa (101 cases), and Kebon Bawang urban villages (101 cases). In August, a higher number of COVID-19 cases were reported in several urban villages, including West Pademangan (158 cases), Lagoa (144 cases), Cilincing (131 cases), West Semper (109 cases), West Cempaka Putih (106 cases), and South Rawabadak (105 cases). These urban villages stood out in comparison to the surrounding areas (Figure 2).

The spatial map of rainfall and COVID-19 cases revealed a recurring pattern of changing rainfall levels each month. The surge in COVID-19 cases was not observed solely in urban neighborhoods with low or moderate rainfall. To illustrate, in June, there was an increase in cases in Kenari (114 cases), followed by West Cempaka Putih in July (114 cases), and in August, there was a rise in Lagoa (144 cases), Cilincing (131 cases), West Semper (109 cases), and South Rawabadak urban villages (105 cases). Nevertheless, some urban villages with high rainfall also experienced increased COVID-19 cases. For instance, in April, Petamburan (100 cases) reported an increase, while in July, both Lagoa (101 cases) and Kebon Bawang urban villages (101 cases) showed a rise. Additionally, in August, West Pademangan (158 cases), Johar Baru (127 cases), and West Cempaka Putih urban villages (106 cases) had increased cases. This data highlighted that increased COVID-19 cases could occur in urban villages with high, medium, or low rainfall levels (Figure 3).

Discussion

Learning from the COVID-19 pandemic will enable a more robust emergency response to possible similar events. This study's results make it possible to identify solutions related to the role of climate in influencing the pandemic, which can then be used for future control of COVID-19 and other infectious diseases affected by climate variables.

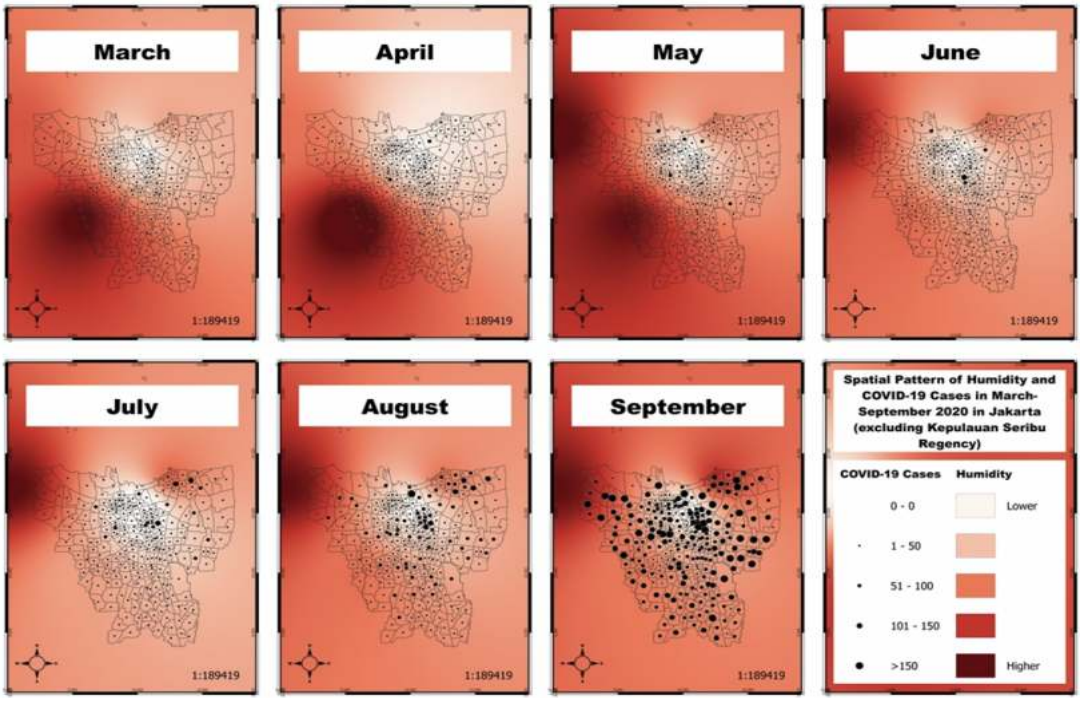

Figure 2. Spatial Patterns of Humidity with COVID-19 Cases[12,13]

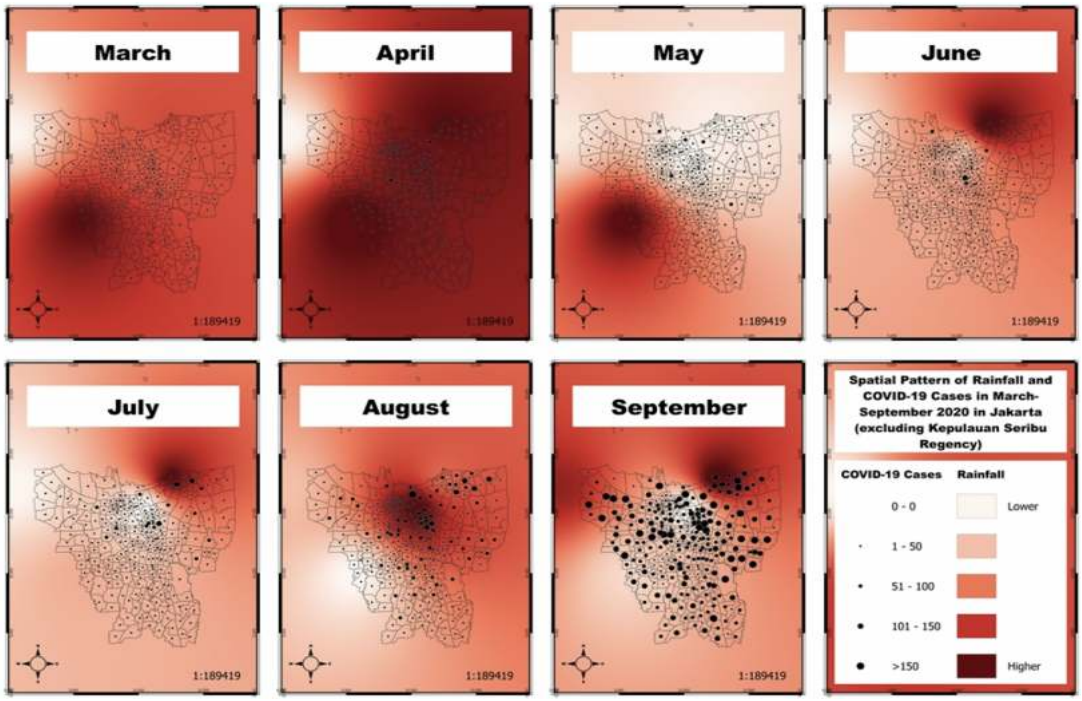

Figure 3. Spatial Patterns of Rainfall with COVID-19 Cases[12,13]

Temperature and COVID-19

According to this study, there was no significant association between temperature (minimum, maximum, and average) and COVID-19 cases in Jakarta. These findings were congruent with a study in Norway, which found that the minimum and average temperature variables were not substantially correlated with COVID-19 cases.[18] The implications contradict the recent findings by Tosepu, *et al.*, who evaluated the association between average temperature and COVID-19 cases in Jakarta.[19] According to that study, the average temperature was significantly correlated with COVID-19 cases. However, several other variables (minimum and maximum temperatures) showed no significant correlation with COVID-19,[19] which is still consistent with this study.

Many studies from different nations concur that raising the temperature might hasten the inactivation of SARS-CoV-2, although it still takes time.[8,20,21] At the temperature conditions in Jakarta, which ranged from 25.42°C to 33.85°C, the inactivation process of SARS-CoV-2 took under two days on the surfaces of stainless steel, glass, cotton cloth, and vinyl, two days on polymer paper surfaces, and under five days on a paper surface without any attempt at disinfection.[13,21] These facts confirm that SARS-CoV-2 can still be transmitted to people who do not properly implement health protocols and large-scale social restrictions. This condition is increasingly becoming a threat, related to the results of the Statistics Indonesia poll on public behavior in September 2020, which found that around 26.46% of the general population still did not implement health protocols effectively.[22,23]

Although this study reported a statistically insignificant relationship between temperature and COVID-19 cases, it is still possible to review the relationship through weekly graphical analysis in Jakarta, which shows a trend of COVID-19 cases increasing as temperature increases. In addition, several other factors also play a role in influencing COVID-19 cases in large cities, such as Jakarta, including high mobility, population density, and household conditions.[18]

Humidity and COVID-19

The correlation analysis of humidity and COVID-19 cases in Jakarta revealed a significant relationship with a very strong correlation. The negative sign indicated that the lower the humidity, the higher the number of COVID-19 cases. Furthermore, Biryukov, *et al.*, stated that an increase in relative humidity from 20% to 80% shortened the half-life of the SARS-CoV-2 virus from 15.3 hours to 8.3 hours.[24] Prayitno, *et al.*, proposed that relative humidity affects the effectiveness of sunlight in the virus inactivation process.[8] The average humidity in Jakarta ranges from 66.93% to 82.14%, and this showed

a decline from March to September 2020, correlating with an increase in the half-life of the SARS-CoV-2 virus.[13,24] The persistence of this virus on the surface of objects or in the air can increase the likelihood of transmission to people who do not follow proper health protocols.[23]

An epidemiological study in Bangladesh showed high humidity can significantly decrease COVID-19 transmission.[25] Meo, *et al.*, found an association between a reduction in daily cases and fatalities from COVID-19 and an increase in humidity (negative correlation) in the Gulf Cooperation Council countries.[26] This finding contradicts those of Tosepu, *et al.*, who concluded that humidity is not correlated with COVID-19 cases.[19]

Weekly graphical analysis in Jakarta showed that COVID-19 cases have increased along with a decrease in humidity. This result aligned with spatial analysis, which showed that urban villages with low humidity experience more cases earlier than those with high humidity. These results further strengthen the significance of the relationship between humidity and the negative pattern of COVID-19 cases in Jakarta.

Rainfall and COVID-19

The analysis of the relationship between rainfall and COVID-19 cases in Jakarta revealed a strong and significant correlation. Interestingly, the direction of this relationship was inverse, as the amount of rainfall and the number of cases appeared to be inversely related. These findings aligned with a study in the United States, which found a notable negative correlation between rainfall and COVID-19 cases.[27] Similarly, a study conducted in Norway revealed a strong relationship with a negative correlation between rainfall recorded at 7:00 a.m. and COVID-19.[18] There are several theories for this inverse relationship, one of which is that people are likelier to stay at home during the rainy season.[18] Interestingly, these findings contradict the results of a previous study conducted in Jakarta, which explored the connection between rainfall and COVID-19 cases. According to that study, rainfall had no significant correlation with COVID-19 cases.[19]

The results obtained from the graph analysis were consistent with the correlation examination on the relationship between rainfall and COVID-19 cases in Jakarta. The findings indicated a strong and significant negative association, suggesting that a decrease in rainfall corresponds to an increase in COVID-19 cases. Moreover, the spatial analysis demonstrated that rainfall patterns exhibit consistent monthly variations. The increase in cases occurred in urban villages with low, moderate, and high rainfall. It can be concluded that high and low rainfall conditions do not affect the pattern of the spread of COVID-19 cases.

These spatial analysis results differed from the correlation above, which showed a relationship between rainfall and COVID-19 cases in Jakarta. The difference between the statistical and spatial analysis results between rainfall and COVID-19 could be caused by the spatial pattern of cases generated from the addresses of sufferers, which may differ from the location of transmission. As a result, the spatial pattern of cases may not align with the real pattern when observed from the site of infection.[14] These limitations could be taken into consideration in future study.

Conclusion

Environmental conditions with high humidity and rainfall can reduce COVID-19 cases. Although this study reported a statistically insignificant relationship between temperature and COVID-19 cases, it is still possible to review the relationship through weekly graphical analysis in Jakarta, which shows a trend of COVID-19 cases increasing as temperature increases. Nevertheless, society can take lessons from this study to always be vigilant and continue to implement health protocols in light of climate's role in affecting pandemic conditions. In addition, the Special Capital Region of Jakarta Provincial Health Office needs to consider these geographical and temporal differences to implement more specific COVID-19 prevention and control strategies based on the varying levels of risk in regions with diverse climatic conditions.

Abbreviations

COVID-19: coronavirus disease 2019; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2.

Ethics Approval and Consent to Participate

This study was approved by the Research and Community Engagement Ethical Committee, Faculty of Public Health, University of Indonesia, No. 210/UN2.F10.D11/PPM.00.02/2021.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

COVID-19 cases data: https://corona.jakarta.go.id/id/data-pemantauan

Climate data: https://dataonline.bmkg.go.id/akses_data.

The base map of Jakarta: https://gadm.org/maps/IDN/jakartaraya.html.

Coordinates of the weather monitoring station: https://www.gps-latitude-longitude.com/

Authors' Contribution

VYS: designed the methods, acquired the funding, and critically revised

the important intellectual content. END: completed overall manuscript structure and critical revision for essential intellectual content. YAS: significant contributions to the concept, work design, data interpretation, data collection, analysis, and paper drafting. DS: final approval of the version to be published and critical revision for essential intellectual content. E: data analysis and made critical revisions to the important intellectual content.

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Kesmas: Jurnal Kesehatan Masyarakat Nasional (Kesmas: National Public Health Journal)

Oral Manifestations in COVID-19 Patients Associated with Oral Hygiene in Aceh, Indonesia: A Literature Review

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Abstract

COVID-19 became a pandemic because of its high-speed transmission via salivary and airborne droplet routes. Viruses can enter host cells through ACE-2 receptors in various human organs, including the oral cavity. The oral manifestations that arise include white plaque, ulceration, burning sensation, oral mucositis, depapillation of the tongue, dry mouth, halitosis, and loss of the sense of taste. Poor oral hygiene, comorbidities, decreased immunity, and stress can exacerbate these manifestations. This review study aimed to report various oral manifestations of COVID-19 related to oral hygiene. Relevant articles were identified from PubMed, ScienceDirect, Elsevier, and Google Scholar. Out of the 60 articles selected, only 36 could be reviewed. The World Health Organization recommends early detection for individuals with suspected exposure to the COVID-19 virus to control its spread, including checking for oral manifestations. Oral hygiene is an important factor affecting the manifestations of the oral cavity of COVID-19 patients, so examination of the condition of oral hygiene is recommended in the medical management of COVID-19 patients. To conclude, oral hygiene is related to the emergence of oral manifestation in COVID-19-infected patients.

Keywords: COVID-19 infection, oral hygiene, oral manifestations

Introduction

Coronavirus disease 2019 (COVID-19) became a pandemic because of its high-speed transmission through close contact between individuals, primarily through saliva droplets and aerosols.[1] One of the complaints most often heard from sufferers of COVID-19 is the loss of their sense of taste and smell. This complaint can be used as an early marker of COVID-19 infection in humans.[2] Various studies have shown oral manifestations in patients infected with COVID-19. A study in Northern Italy showed 10% and 11% taste and smell disturbances in COVID-19 sufferers quarantined at home.[3] Another study showed that 51.9–78.9% of quarantined patients experienced taste disorders due to the presence of angiotensin-converting enzyme 2 (ACE-2) inhibitor receptors, which are commonly found in the oral mucosa and are cellular receptors for severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2).[4]

Other than impaired sensory function, symptoms of the oral cavity that have also been reported in patients with COVID-19 include atrophy of the tongue, cheilitis, red plaques on the palate, canker sores (ulceration), petechiae, xerostomia, and halitosis.[5-10] Severe thrombocytopenia also triggers the above phenomena of oral disorders.[11] Previous studies found ulcerated lesions on the lower lip in three patients infected with COVID-19 without comorbidities and a history of recurrent ulcers before infection.[3,10]

Several studies have stated that oral manifestations are also related to poor dental and oral hygiene, opportunistic infections, stress, decreased immunity, and a hyperinflammatory response to COVID-19.[12-16] Mohammed, *et al.*, stated that each COVID-19 patient could have more than one manifestation of the oral cavity: loss of the sense of taste and dry mouth accompanied by a burning mouth sensation in 8.9% of patients.[17] The number of canker sores experienced by COVID-19 patients varies, as they are triggered by stress and the condition and cleanliness of the patient's oral cavity.[18] As the dentist works on the oral cavity daily, it is more susceptible to COVID-19 infection through a patient's droplets. This condition will contribute to the dental professional sector on detailed intraoral screening before dental treatment and help initiate the best treatment plan for lesions related to COVID-19.[18] This review study aimed to report various oral manifestations of COVID-

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19 described in the literature related to oral hygiene.

Method

This review study focused on oral manifestations in COVID-19 patients associated with oral hygiene statuses. Online articles were searched in PubMed, ScienceDirect, Elsevier, and Google Scholar. Out of the 60 articles selected, 36 met the inclusion criteria (published within the last four years for articles regarding oral lesions related to oral hygiene and within the last three years for those related to COVID-19 keywords and oral manifestations and their relationship to predisposing factors in COVID-19 patients). Articles with irrelevant summaries were excluded. Only review or research articles available for open access were considered. The search terms used in Medical Subject Headings (MeSH) were "COVID-19 and its oral manifestations," "COVID-19 and its predisposing factors in patients," and "mouth hygiene status in COVID-19 patients" (Figure 1).

The first three authors independently assessed paper eligibility based on the title and abstract. If necessary, complete papers were obtained to determine eligibility status. Disagreements were resolved through consultation with the fourth and fifth authors. Papers in languages other than English were excluded if translations were unavailable. Full-text papers meeting the eligibility criteria were then evaluated. Study results on oral manifestations in COVID-19 patients and their relationship to oral cavity hygiene were then compiled. Finally, the articles were thoroughly, critically, and objectively reviewed and discussed using the same methods as previous studies.

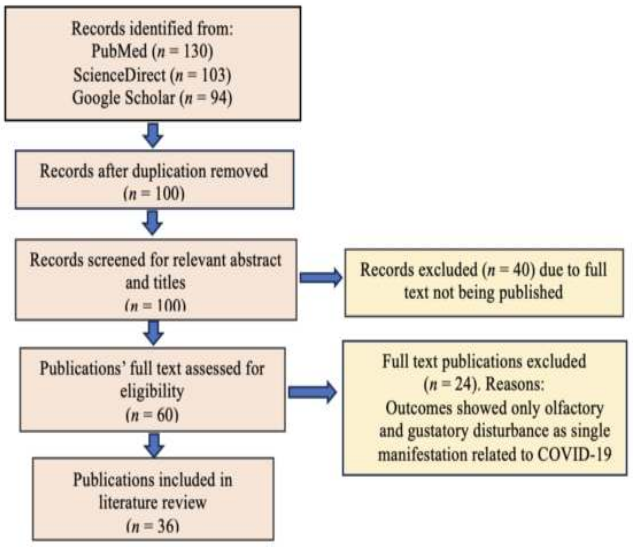

Figure 1. Literature Flow Chart

Results and Discussion

COVID-19 first appeared in Wuhan, China, in December 2019 and was declared a pandemic by the World Health Organization on 11 March 2020.[19] COVID-19 is caused by SARS-CoV-2. This virus is a type of betacoronavirus that causes severe and fatal symptoms in humans. The SARS-CoV-2 resembles SARS and MERS because it has an envelope, is single-stranded, and has monopartite ribonucleic acid.[20] Coronaviruses comprise four proteins: spicules, membranes, envelopes, and nucleocapsids. The spicule is composed of a transmembrane trimetric glycoprotein and has two subunits. Subunit one plays a role in the attachment of the virus to the host, while subunit two plays a role in the fusion of the virus into the cell membrane.[21]

The COVID-19 virus is transmitted between individuals via droplets (less than one meter) from infected individuals with coughing and sneezing symptoms. Transmission of these droplets does not have to be through direct contact but can also be through shared objects around the patient.[22,23] According to the Indonesian Ministry of Health, the symptoms of COVID-19 are divided into the following five groups: asymptomatic (without clinical symptoms); mild symptoms: fever, fatigue, impaired smell and taste; moderate symptoms: symptoms of pneumonia (cough, fever, shortness of breath); severe symptoms: symptoms of pneumonia + one of the following features: respiratory rate >30x/minute, severe respiratory distress, or oxygen saturation <93% in room air; critical: acute respiratory distress syndrome, sepsis, or septic shock.[24] This severity level is also related to the patient's comorbidities, such as cardiovascular disease, diabetes, cancer, and chronic respiratory disease.[19]

Pathogenesis of Oral Manifestations in Patients Infected with COVID-19

The receptor for SARS-CoV-2 in humans is ACE-2, which is widely found in the lungs, heart, ileum, kidneys, and bladder. This process also involves several membrane attachment and fusion proteinase enzymes, such as disintegrin and metallopeptidase domain 17, transmembrane protease serine 2, TNF-converting enzyme, vimentin, and clathrin. The virus enters the cell nucleus through endocytosis, where the virus will enter the cell nucleus to replicate. These viral particles form viral proteins for biosynthesis and are released by the host cell.[25] The severe condition in COVID-19 patients is caused by a cytokine storm resulting from a drastic increase in IL-6 and IL-8 production. It triggers severe inflammation throughout the body due to its function as a chemoattractant for neutrophils and T cells.[26,27]

The ACE-2 receptors can also be found in the oral mucosa and salivary glands. Saliva acts as a solvent and

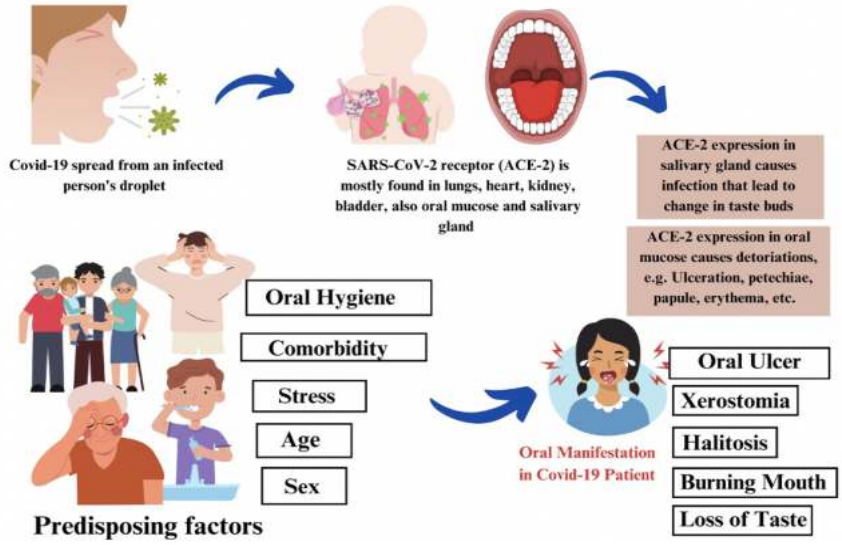

Figure 2. Illustration of Oral Manifestation in COVID-19 Patients and Its Predisposing Factors[7,17,18,28]

regulates the condition of taste receptors. Infected salivary glands can alter the function of taste buds due to damage to them. ACE-2 is also found in the gingival sulcus, which causes edema and necrosis of the interdental papillae. Expression of ACE-2 in the oral mucosa can also cause other damage, such as ulcerated lesions, plaques, petechiae, erythema, papules, and macules (Figure 2).[7,28]

The risk of COVID-19 infection increases in the elderly, who have comorbidities (cancer or cardiovascular, kidney, or chronic lung disease), diabetes, immunocompromised conditions, obesity, and sickle cell anemia.[29] Some reported results related to oral manifestations in patients infected with COVID-19 are as follows:

- White plaques on the dorsal tongue and yellowish pinpoint ulcers appeared 21 days after the patient was infected with COVID-19. These symptoms may have arisen due to the patient's systemic condition and treatment while infected with COVID-19.[7]
- Multiple painful ulcers of varying sizes and irregular margins were found on the hard palate and tongue. The first case appeared five days after the initial symptoms, while the second case appeared one week after hospitalization.[8]
- Ulcer/aphthous lesions on the lips, tongue, and hard palate six days after the patient was confirmed to have COVID-19, especially with comorbidities.[10]
- The sensation of pain, burning mouth, and nonspecific white plaque on the ventral tongue appeared in patients seven days after COVID-19 was confirmed. These symptoms were due to psychological stress during COVID-19 and the patient's comorbidities. The above symptoms, coupled with the loss of the sense of taste, are directly related to the COVID-19 infection.[12]
- Oral mucositis with bilateral diffuse erythema, depapillation of the tongue, and dry mouth was found in a patient nine days after COVID-19 was confirmed. This appears to have been caused by mucosal hypersensitivity to COVID-19.[12]
- Ulcer lesions on the tongue and burning mouth sensation due to infection of the salivary glands by COVID-19.[16]
- A dry mouth sensation that the patient had never experienced before being infected with COVID-19.[29]
- Symptoms of dry mouth and damage to the taste buds caused loss of taste buds during infection.[30]
- Glossitis, depapillation of the tongue, mucositis, and burning mouth sensation.[31]
- Impaired sense of taste in 67.8% of COVID-19 patients on days 10–14 of infection.[32]
- Oral cavity lesions were more severe and widespread at older ages, and the severity of the infection was higher. While, gender did not play a role in differences in the appearance of the lesions.[33]

Predisposing Factors for Oral Manifestations in Patients Infected with COVID-19

Predisposing factors that increase the severity of oral manifestations are poor oral hygiene, opportunistic infections, comorbid conditions, stress, age, decreased immunity, and the hyperinflammatory response to COVID-19. High exposure to systemic drugs, especially in hospitalized patients, can also affect the gut microbiota and cause oral manifestations.[12,14,16,22,30-32]

Age and sex characteristics are said to be related to oral manifestations in COVID-19 patients. A study by Binmadi, *et al.*, revealed that oral manifestations in COVID-19 patients are mostly experienced by women aged 45–55 years.[18] However, statistically, there is no relationship between age and sex in the oral manifestations experienced.[18] A previous study also stated that more oral manifestations were proportionately found in older patients infected with COVID-19. This result is associated with decreased immunity in older patients.[12] Several studies also stated no significant difference in oral manifestations among the 20 COVID-19 patients.[17,18,20]

COVID-19 patients with comorbidities experienced more oral manifestations than patients who did not have comorbidities. A study by Katz, *et al.,* stated that COVID-19 patients with diabetes are 10.54 times more at risk of experiencing recurrent aphthous stomatitis (recurrent canker sores), p-value<0.05.[29] Comorbidities are related to oral manifestations in COVID-19 patients associated with the drugs consumed by individuals with systemic diseases.[29,30]

Based on the results of the case reports studied, the lesions in the oral cavity that appear in COVID-19 patients are related to the stress they experience.[8] This is in line with a study conducted by Nwachukwu, *et al.,* showing that the majority of the stress levels experienced by people during the COVID-19 pandemic were moderate and high.[31] Moderate to high-stress levels in this study were also influenced by the participants' demographic backgrounds, where the most dominant age was 26–45 years, and those participants were productive and predominantly employed.[31] Kaligis, *et al.,* stated that stressful conditions tended to increase during the productive age during the COVID-19 pandemic because the imposition of restrictions on people's mobility, financial burdens, uncertainty about the end of the pandemic, and fears of contracting or transmitting COVID-19 caused anxiety and stress in some communities.[32]

Previous studies showed that oral manifestations during COVID-19 infection could be affected by poor oral hygiene.[12,20] According to Abubakr, *et al.*, moderate to poor oral hygiene significantly increased oral manifestations in patients infected with COVID-19, such as canker sores and halitosis.[14] A study conducted by Sinjari, *et al.,* supports the results of this study that show there is a decrease in the level of oral hygiene when patients are hospitalized due to COVID-19 infection.[20]

Kartikha, *et al.*, also stated that the cleanliness of the COVID-19 patient's oral cavity affected the oral cavity symptoms experienced by the patient.[6] The behavior of maintaining oral hygiene while the patient is infected with COVID-19 needs to be improved, especially in terms of using a toothbrush after breakfast, using floss to clean between the teeth, and visits to the dentist that are rarely made (less than once every six months). Good oral hygiene prevents plaque formation on the surface of the teeth and mucosa, so there is no disturbance in the balance of the oral microbiota. The condition of a healthy oral mucose also prevents the occurrence of oral symptoms, such as bad breath, canker sores, and dry mouth, that can disturb the comfort of individuals who experience them.[33]

Management of Oral Lesions in COVID-19 Patients

Oral lesions in COVID-19, such as loss of taste, mostly decrease and heal without any treatment intervention.[12-14] To manage symptomatic lesions such as canker sores, a dental professional should be consulted. Improving oral hygiene by brushing twice daily, interdental flossing, and scrubbing the tongue can help maintain the balance of normal oral microbiota to prevent the emergence of canker sores, dry mouth, and halitosis.[6,17,20]

Conclusion

Based on the results and discussion, it can be seen that oral hygiene can affect the manifestation of the patient's oral cavity, such as white plaque, ulceration, pain, burning sensation, oral mucositis, depapillation of the tongue, dry mouth, halitosis, and loss of the sense of taste. Since oral hygiene is related to the emergence of oral manifestation in COVID-19 patients, it is suggested that dental professionals give dental education on how to improve oral hygiene adequately. It is also suggested that the dental professional focus more on a detailed intraoral examination before initiating any dental procedure on a confirmed or suspected COVID-19 patient.

Abbreviations

COVID-19: coronavirus disease 2019; ACE-2: Agiotensin-Converting Enzyme 2; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2.

Ethics Approval and Consent to Participate

Not applicable.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The authors have full access to all the data in the study and take responsibility for the data integrity.

Authors' Contribution

MH and MA conceptualized, investigated, wrote the manuscript, and validated the study. NN, IS, and SU wrote the main manuscript text, and all authors contributed to interpreting the results.

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Improving Adolescent Mental Health Through Experiential Learning During the COVID-19 Pandemic

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Abstract

Good adolescent mental health is a good investment for a country. During the COVID-19 pandemic, many adolescents did not carry out productive activities, possibly changing their mental health. Experiential learning facilitates metacognition, shapes adolescent cognitive processes, improves performance and problem-solving, and makes learning more meaningful and authentic. This study aimed to explore adolescents' mental health conditions and how experiential learning affects adolescents' mental health. Using a qualitative approach, the data collection through Google Forms questionnaire, FGDs, and interviews using the HEADSS instrument was conducted in September 2022 in Kebon Gedang Village, Batununggal Subdistrict, Bandung City, West Java Province, Indonesia. This study involved 73 adolescents aged 10-19 years as population. Still, only 59 participants were valid as a sample and willing to participate in making oil-based soap as a change for the monthly activity held by Integrated Health Care. The results showed that experiential learning by making oil-based soap at home improved adolescents' mental health by 80%. Following the learning objectives, this activity developed adolescents into healthy and economically successful individuals while significantly contributing to their community.

Keywords: adolescent, experiential learning, mental health

Introduction

World Health Organization suggests perfect physical, mental, and social well-being comprise human life.[1] Mental health affects morbidity and mortality worldwide.[2] Good adolescent mental health is a good investment for a country.[3] Emotional and social developments during adolescence later influence adult health conditions.[4,5] Mental disorders contribute to disability among adolescents.[6] Therefore, some efforts must address adolescent mental health globally and locally. Poor mental health conditions negatively impact educational attainment, social relationships, community productivity, and quality of life in the short term and potentially across generations.[7] Even temporary mental health problems can cause long-term disruptions in the learning and working environments.[7,8]

Mental health conditions must be considered, especially during a pandemic. According to data from the Indonesian Ministry of Health, the coronavirus disease 2019 (COVID-19) pandemic has had mental and neurological impacts on society.[7,9] COVID-19 extensively impacts various aspects of life, including mental health disorders, and its adverse effects cannot be known and anticipated, especially among adolescents.[1] Based on the latest data, approximately 1 in 7 adolescents aged 10-19 years worldwide were diagnosed with a mental health disorder yearly; suicide kills nearly 46,000 young people becoming one of the top five causes of death in that age group.[2,10] A survey stated that they often felt depressed or had low interest in activities.[7]

The adolescent development phase is a period of rapid change and exposure to new risk factors, including physical changes, peer pressure, educational pressure, and sexual exploitation.[2] Mental health disorders are among the five diseases causing the most misery, death, and dysfunction among young people.[2,11] The increased prevalence of mental illness indicates the need for literacy and a diagnosis of adolescent mental health.[12] Mental health problems can be adequately detected and treated by useful activities involving adolescents, families, and schools, like making soap, snacks, and other activities. However, difficulties in accessing mental health services lead to delays in treatment.[13,14]

Efforts for adolescents' mental health integrate cur-

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ricular and co-curricular experiences, encourage seamless learning opportunities, environments, and experiences for students, and encourage pedagogical innovation and experimentation.[15] Experiential learning is a pedagogical approach emphasizing the learning process and engagement with ideas, differences, and interpersonal relationships.[15] Interventions to develop self-care practices or inner life are either highly structured or outside the norm of daily experiences.[15] Furthermore, social support is frequently cited as critical in promoting personal well-being.[15]

Professionals diagnose an increased prevalence of mood and anxiety disorders due to poor health perceptions, inadequate health literacy, and difficult health-seeking.[12,16] Health service innovations must provide responsive and easily accessible innovative adolescent mental health services to adolescents. Mental health care can be obtained in Integrated Health Care (IHC) because of its flexibility and responsiveness to provide an education suitable for adolescents' mental needs.[17,18]

Experiential learning facilitates metacognition shapes adolescents' cognitive processes, and improves performance and problem-solving by making easy-to-find house materials and tools.[19,20] In psychology, experiential learning allows students to learn meaningfully and authentically.[21] Experiential learning leads students to better learning outcomes and cognitive and emotional-social abilities.[21] Students can cooperate, communicate, and use their critical thinking more under their teachers' guidance until the final submission and presentation of their projects than conventionally assessed knowledge alone.[22] According to Kolb, experiential learning analysis reveals five themes: learners engaged active participants, knowledge in place and time, learners exposed to new experiences involving risk, learning requires investigation into specific real-world problems, and critical reflection acts as a mediator of meaningful learning.[23,24] Therefore, this study aimed to explore how experiential learning affects adolescent mental health, as well as examine their mental condition during the COVID-19 pandemic.

Method

This study used a qualitative approach with 73 adolescents aged 10-19 years in Kebon Gedang Village, Batunanggal Subdistrict, Bandung City, West Java Province, Indonesia, as the population. However, only 59 participants were willing to participate. The data was collected by completing questionnaires through Google Forms, focus group discussions (FGD), and interviews. The questionnaire used was the HEADSS instrument (Home, Education/Employment, Eating, Activities, Drugs, Sexuality, Safety, and Suicide) from Cohen, *et al.*, which included: 1) living conditions, 2) eating habits, 3) daily activities and leisure use, 4) use of cigarettes, drugs, and addictive substances, 5) identification of sexual problems, 6) identification of security problems, and 7) identification of depression and suicide problems.[25]

Some indicators were used to measure the level of depth and variables.[26] The variables used in this study were home, eating habits, sports, smoking and drug use,

$$Precentage = \frac{the\ total\ of\ participants\ that\ fill\ out\ the\ form}{the\ total\ of\ participants} \times 100\%^{1}$$

Formula 1. Formula Determines Participation in Filling Out the Google Form

Table 1. Psychosocial Profile Using the HEADSS Instrument Before and After Experiential Learning

Question		Before		After	
		Yes (%)	No (%)	Yes (%)	No (%)
Home	Living with parents	93	7	93	7
	There are adults you trust and are comfortable discussing your problems with	30	70	79	21
	Do you think your behaviors and habits at home/school are not good?	24	76	63	17
	Is there anything else that happened at home/school that you would like to tell us about?	80	20	39	61
Eating habits	Do you like your breakfast, lunch, and dinner menus?	54	46	76	24
	How do you eat when you are stressed? Will you overeat, or will your appetite decrease?	22	78	89	11
	Any changes in your weight lately	35	65	35	65
Sports	Are you a member of any sports/hobby groups?	50	50	45	54
	Do you have friends outside of your group?	96	4	96	4
	How is your relationship with your peers?	100	0	100	0
Smoking and drug use	Many teenagers your age are already familiar with cigarettes or drugs/alcohol, are any of your friends like that?	41	59	22	78
	How about you? Have you ever consumed cigarettes/alcohol/drugs (drugs)?	0	100	0	100
A sense of security	Do you feel unsafe in the community?	0	100	100	0
	Do you feel unsafe in the playground?	10	90	30	70
	Do you feel unsafe on the road?	40	60	13	87
	Have you ever felt unfortunate?	47	53	50	50
	Have you ever committed an act that could harm yourself (self-harm, set a fire)?	20	80	85	15

and a sense of security. Each variable was represented in a question item to measure the psychological level of the respondent. The measurement was done to find the percentage of the respondent's mental condition. Formula 1 used to determines participation in filling out the Google Form.

The data collection was done through several steps. The first step was 59 participants filled out the HEADSS questionnaire using Google Forms. Second, the authors and participants conducted FGD via Zoom Meeting to discuss the suitable activities that could be done at home as a form of experiential learning. After choosing the activity, the participants would be directed to present and promote their products. The participants would be interviewed separately about their activities at home, how they felt about the activities, and whether they were happy to earn additional income.

Results

This study's results were based on general questions about the surrounding environment before applying experiential learning through Google Forms using the HEADSS instrument. After experiential learning, adolescents increasingly trusted adults to tell them their problems. In addition, they prefer to be at home. Questions and responses are shown in Table 1 before and after experiential learning.

Of 59 respondents, 29 said their activities during the pandemic were watching TV and doing household chores (Table 2). Therefore, they felt bored to the point of depression because there was no activity like social interaction with friends. Therefore, the authors proposed several productive activities that test creativity, knowledge, and skills. Some activities offered were making oil-based soap and snacks and sewing clothes. These activities were proposed through FGD via Zoom Meeting, and the results showed that 40 respondents chose to make oil-based soap (Table 3).

The experiential learning through making oil-based soap activity was done individually at home since there was a Large Scale Social Restriction then. However, after the activity, the participants were asked to present and promote their products in IHC and were interviewed separately. The questions were about experiential learning and their feelings about doing it at home (Table 4).

Table 2. Questions Before Experiential Learning (n = 59)

Question	Yes	No
Do you have productive activities?	59	0
Are you bored staying at home?	59	0
Do you want to have additional income?	59	0
Do you feel the impact of Covid-19?	54	5

Table 3. Activities of Experiential Learning (n = 59)

Activities	Total
Making oil-based soap	40
Making snack	10
Sewing clothes	9

Table 4. Questions After Experiential Learning (n = 59)

Question	Yes	No
Are you satisfied with productive activities?	57	2
Are you happy staying at home?	52	7
Are you satisfied with the additional income?	59	0

Discussion

Youth capacity building must be prepared through youth assistance to the youth community. The COVID-19 pandemic has had a significant impact on their mental health. This condition directly impacts the attitude and personality of young people experiencing a prolonged pandemic.[27] According to van der Westuizhen, *et al.*, the most common factors influencing emotional well-being in mental health are money and possessions, academic achievement, and risky behavior.[28] Only one focus group recognized intrapersonal strength; one participant stated having a "positive mindset" (girl aged 15-19).[12]

Experiential Learning can make learners feel directly involved in the learning process regarding physical materials and interactions between materials as chemical processes, e.g., making oil-based soap. In addition, the hands-on experience of soap making provides an experience for participants to interact with the team, express opinions, and support each other. This activity makes adolescents feel happy and gain new knowledge and skills, and they want to develop this practice into a business if they have enough capital.[29] This means improving the initial condition is necessary for optimal mental health.

The previous studies had significant changes regarding social skills and mental health.[19,30] Those studies stated that experiential learning positively changes adolescents' abilities, such as memory, creativity, and sensitivity, impacting social interaction and decreasing anxiety and depression.[19,30] In experiential learning by making oil-based soap, the participants could learn about the physical aspects of materials such as oil, chemicals, and temperature increases due to chemical reactions.

At the end of the simulation, they revealed the learning process experienced from this activity; they learned to recognize and express their opinions, interacted with friends in groups and conveyed their ideas, and improved

cognitive and metacognitive processes (increasing awareness of one's thinking processes). Their response was in line with the experiential learning conducted by Falloon.[31] Monitoring adolescents in the IHC generally deals with physical health examinations without asking about adolescents' mental health. By implying this study's results, health workers will know the importance of experiential learning for adolescents, especially aged 10-19 years.

Conclusion

Experiential learning in the form of making oil-based soap can make adolescents feel happiness and satisfaction with themselves during the COVID-19 pandemic, thereby improving the mental health of adolescents. Experiential learning facilitated metacognition, shaped students' cognitive processes, improved performance and problem-solving, and made learning more meaningful and authentic. The study results show that exploring the mental health condition and experiential learning among adolescents improved adolescents' mental health by 80%. This activity makes adolescents follow the learning objectives of developing into healthy individuals, economically successful, and significantly contributing to their community.

Abbreviations

COVID-19: coronavirus disease 2019; IHC: Integrated Health Care; FGD: focus group discussion.

Ethics Approval and Consent to Participate

Ethical approval for this study was issued by the Ethics Committee of the Universitas Pendidikan Indonesia because of prioritization involving stakeholders and using multiple criteria.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

All data collection regarding the respondents' mental health generated or analyzed during the current study was available from the authors upon reasonable request.

Authors' Contribution

Y designed this research and wrote the results; AH, ESP, and BR collected the data; UW and MK visualized the data.

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The Influence of the COVID-19 Pandemic on Physical Growth and Personal Hygiene of Adolescents

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Abstract

The COVID-19 pandemic has influenced the community's lifestyle, including adolescents' behavior. One aspect majorly affected was physical growth, which encompasses several areas, including nutritional status and personal hygiene. Maintaining the quality of physical growth is very important, even beyond the pandemic. Therefore, this study aimed to determine the influence of the COVID-19 pandemic on adolescents' nutritional status and personal hygiene. A literature review method was used through a bibliometric and content analysis of publications obtained from databases such as Google Scholar. The articles obtained were classified by publication year, study location, keywords, and journal titles. Based on the literature search, 11 articles were found on the influence of the COVID-19 pandemic on the nutritional status of adolescents, and 10 articles discussed the effect on personal hygiene. After reviewing the articles, it was concluded that the pandemic influenced adolescents' nutritional status and personal hygiene.

Keywords: adolescents, COVID-19, nutritional status, personal hygiene

Introduction

Coronavirus disease 2019 (COVID-19) is caused by an infection of the virus named SARS-CoV-2. The etiology or main cause is the transmission from one individual to another. This disease occurs through respiratory droplets produced when a carrier coughs, sneezes, or talks.[1] This virus belongs to the family of coronavirus, which induces Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS).[2,3]

The first case of COVID-19 was found in Wuhan, China, towards the end of 2019. Based on data from the World Health Organization until 30 September 2020, the cases worldwide reached 44 million, with 1,174,624 deaths.[4] The Indonesian Ministry of Health data reported that 1 in 8 cases was found among children.[5] Furthermore, the pandemic significantly affected adolescents' physical growth,[5] encompassing several aspects, including nutrition and personal hygiene.[6] Many adolescents suffered a decrease in immunity caused by food insecurity.[7] The nutrition aspect relates to their daily food intake, while personal hygiene is concerned with maintaining cleanliness. When both aspects are well maintained, the physical growth of adolescents can proceed optimally.[6,7]

The continuity of physical growth among adolescents needs to be ensured,[8-10] given that the pandemic has impacted their behavior.[11-13] Therefore, studies are needed to examine the influence of COVID-19 on adolescents' physical growth. The results will help stakeholders identify the necessary steps to overcome the problem. These studies can be a reference or academic resource for future health emergencies, including pandemics.

The physical and personal hygiene of adolescents plays a critical role in their growth and development. Both characteristics are also associated with the welfare and health of the next generations.[8] Studies are needed to provide references for public health and government readers to produce health policies in the post-pandemic. Therefore, this study aimed to examine the influence of the COVID-19 pandemic on adolescents' nutritional status and personal hygiene.

Method

This study used a literature review method with several scientific literature published between 2020 and 2022 collected from sources such as Google Scholar, PubMed, and Elsevier. A bibliometric and content analysis of publications obtained was conducted and classified based on the publication year, study location, keywords,

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and titles. The keywords used were "the effect of the COVID-19 pandemic on adolescents' nutritional status" and the "effect of the pandemic on adolescents' personal hygiene." The inclusion criteria were articles published in English, in international journals, and focused on the impact of the COVID-19 pandemic.

Results

A bibliometric and content analysis of publications obtained was conducted, and the articles were classified based on the year, location, keywords, and titles. Based on the literature search, 11 and 10 articles that discussed the influence of the pandemic on the nutritional status and personal hygiene of adolescents were found. The summary of these articles is shown in Tables 1 and 2.

Discussion

The Influence of the COVID-19 Pandemic on the Nutritional Status of Adolescents

The COVID-19 pandemic has culminated in significant malnutrition among adolescents. Based on the literature review, 3 papers focused on undernutrition or malnutrition, 7 on overweight, 9 on food insecurity, and 10 on unhealthy food (high-sugar diets, etc). The results showed that the burden of COVID-19 had led to an increase in the number of adolescents suffering from undernutrition and overweight. The government and policymakers have addressed this problem, including providing supplementary food to improve nutrition.[14] Adolescents often consume high-fat and sugar foods, which are unhealthy for their bodies.[14] This condition is influenced by their increased screen time, resulting in less attention to adequate food (preferring fast food) as well as the lack of parental knowledge about healthy food.[16]

During the pandemic, the food supply for the community was significantly disrupted, and the stakeholders' priority was largely focused on treating COVID-19 rather than providing nutrition education.[21] Various policies implemented by the government include school closures to prevent the spread of this virus infection.[18]

Adolescents often consume fast and nutritionally poor foods, culminating in an increase in obese patients. The lack of specific nutritional guidelines also contributed to this issue.[22] Due the government-imposed isolation, adolescents engaged in unhealthy behavior,[19] such as consuming high-sugar foods frequently.[20]

The stamina and nutritional status of adolescents need to be maintained optimally. Good nutrition will strengthen the body's defense system against various diseases, including COVID-19.[35] To prevent nutritional problems during the pandemic, there is a need to reduce adolescents' addiction to fast food and maintain their physical activity according to health standards.[23]

The Influence of the COVID-19 Pandemic on the Personal Hygiene of Adolescents

According to the literature review, 7 papers discussed the impact of the COVID-19 pandemic on personal hy-

Table 1. Articles About the Influence of the COVID-19 Pandemic on Adolescents' Nutritional Status

Author	Year	Type of Study	Population of the Study	Country	Results Summary
Fahim, *et al.*[14]	2021	Qualitative	Childhood (including adolescents)	Bangladesh	Malnutrition in adolescents occurred during this period.
Allabadi, *et al.*[15]	2020	Quantitative	Adolescents	West Bank (Palestine)	Adolescents' dietary habits changed during the pandemic.
Ruiz-Roso, *et al.*[16]	2020	Quantitative	Adolescents	Spain, Italy, Brazil, Colombia, and Chile	The COVID-19 pandemic influenced adolescents' dietary habits.
Kavle, *et al.*[17]	2022	Qualitative	Adolescents	Nairobi and Uasin Gishu Counties (Kenya)	During the pandemic, adolescents seldom consumed junk foods.
Mayurasakorn, *et al.*[18]	2020	Qualitative	Adolescents	Thailand	Food insecurity is expected to be higher during the COVID-19 pandemic.
Pujia, *et al.*[19]	2021	Quantitative	Adolescents	Italy	The COVID-19 lockdown caused significant changes in adolescent behavior.
Bennet, *et al.*[20]	2021	Qualitative	Adolescents	US, India, China, Palestine, Italy, France, Spain, Poland, UK, Australia, and Zimbabwe	The COVID-19 lockdown caused changes in the dietary practices of adolescents.
Akseer, *et al.*[21]	2020	Qualitative	Parents and children (including adolescents)	Kyrgyz Republic	The improvement in undernutrition post-pandemic requires serious efforts from the governments.
Stavridou, *et al.*[22]	2021	Qualitative	Parents and children (including adolescents)	Italy, Spain, Poland, France, Colombia, Chile, Brazil, US, and Palestine	The adolescents' dietary behaviors changed during the pandemic.
Gülü, *et al.*[23]	2022	Quantitative	Children (including adolescents)	Turkey	Obese adolescents increased during the pandemic.
Chi, *et al.*[24]	2021	Quantitative	Adolescents	Hechi City (China)	Malnutrition in adolescents increased during the pandemic.

Table 2. Articles About the Influence of the COVID-19 Pandemic on the Personal Hygiene of Adolescents

Author	Year	Type of Study	Population of the Study	Country	Results Summary
Zenic, *et al.*[25]	2020	Quantitative	Adolescents	Croatia	The behavioral pattern of adolescents, specifically personal hygiene, changed due to the pandemic.
Kim, *et al.*[26]	2022	Quantitative	Adolescents	Korea	Adolescents' personal hygiene behavior changed during the pandemic.
Adelekan, *et al.*[27]	2021	Quantitative	Adolescents	Nigeria	During the pandemic, adolescents need much knowledge about personal hygiene.
Oakley, *et al.*[28]	2022	Qualitative	Adolescents	Ethiopia, Jordan, and Palestine	During the pandemic, adolescents need support from the government to increase their personal hygiene.
Singh, *et al.*[29]	2020	Qualitative	Children (including adolescents)	India	Adolescents' personal hygiene behavior changed during the pandemic.
Meherali, *et al.*[30]	2021	Qualitative	Adolescents	Ethiopia, Lebanon, Kenya, Jordan, South Africa, Ecuador, and Brazil	During the pandemic, adolescents' personal hygiene behavior has caused limited access to reproductive health services.
Ott, *et al.*[31]	2020	Qualitative	Adolescents	US	Adolescents' reproductive health changed during the pandemic.
Riiser, *et al.*[32]	2020	Quantitative	Adolescents	Norwegia	The pandemic has caused limitations in adolescents' knowledge about reproductive health.
Ares, *et al.*[33]	2021	Quantitative	Children (including adolescents)	Uruguay	Adolescents need information about personal hygiene during the pandemic.
Gilic, *et al.*[34]	2020	Quantitative	Adolescents	Bosnia and Herzegovina	Parental and family factors during the pandemic have influenced numerous aspects of adolescents' living, including their personal hygiene.

giene, while 4 focused on external reproductive organs. The pandemic has changed the behavior patterns of adolescents, including their hygiene habits. There were hesitations in going out due to government policies prohibiting gatherings, among other reasons.[25] The grooming duration has changed to approximately 2 hours each day compared to the period before the pandemic.[28]

The pandemic has caused fluctuations in the behavior of adolescents, specifically in maintaining hand hygiene, which has reduced compared to their initial diligence.[26] Optimal growth and development have also been impacted,[30] with the health status becoming less stable. This can be attributed to various reasons, including the lack of literacy regarding personal hygiene, the closure of schools that provide health education, and the lack of interest in paying attention to or watching health education advertisements on television.[32]

The COVID-19 pandemic has led adolescents to consistently use personal protective equipment, such as masks when going outside.[27,34] Clean living behaviors greatly affect the health degree status, reducing susceptibility to viral infections.[36] These behaviors can hinder and prevent the spread of disease-causing viruses, including COVID-19.[35]

The government consistently strives to implement various policies to ensure the optimal physical health of adolescents.[29] During the pandemic, there were challenges in improving and increasing the health degree status,[31] due to the induced changes in behavior. Adolescents are more likely to embrace new knowledge that aligns with their preferences.[33]

Adequate health education needs to be provided, particularly during the COVID-19 period. For instance, adolescents should be able to explain the material they have learned, draw conclusions, and provide examples.[37] There were also additional burdens on healthcare services,[38] which significantly influenced adolescents' immunization.[39,40]

This literature review suggests that adolescents' nutritional status and personal hygiene behavior have been hampered due to the COVID-19 pandemic. The results provide a reference for stakeholders regarding the strategies to countermeasure the growth and development problem among adolescents in the post-pandemic. However, this study has certain limitations, particularly the absence of a review of adolescents' nutritional status and personal hygiene behavior in traditional communities in the post-pandemic

Conclusion

The COVID-19 pandemic has significantly impacted the physical growth of adolescents, as evidenced by their nutritional status and personal hygiene. Therefore, stakeholders, including the government, were recommended to employ this study as a reference or academic resource in future health emergencies. The results can be used in the rehabilitation policy for physical growth in the post-COVID-19 pandemic.

Abbreviations

COVID-19: coronavirus disease 2019; SARS: Severe Acute Respiratory Syndrome; MERS: Middle East Respiratory Syndrome.

Ethics Approval and Consent to Participate

The ethics approval and consent of this study were issued by the Ethical Research Committee of Politeknik Baubau, Number: 108/PL.B/D.A7/PE/VI/2023.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data were collected from Google Scholar, PubMed, and Elsevier, published between 2020 and 2022.

Authors' Contribution

RH conceptualized the review, interpreted the data, and became a corresponding author. AA, WONJS, and SP helped to collect literature and arrange the framework. WOSJ and SMS helped in designing and preparing the manuscript draft.

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Kangaroo Mother Care in Improving Thermoregulation of Premature Babies During the COVID-19 Pandemic: A Case Report

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Abstract

Premature babies lose four times more heat than those with sufficient birth weight. Moreover, their body temperature regulation center does not function properly. This study aimed to investigate Kangaroo Mother Care's effect in increasing premature babies' thermoregulation during the COVID-19 pandemic at Hospital A in Malang City, Indonesia. This study was a case report with data from follow-up checks on premature babies discharged from the hospital. The Kangaroo Mother Care method, carried out by the mother, increased the thermoregulation of premature babies' temperature by 0.2°C compared to the father. It was because women have a slightly higher body temperature than men. The comfortable body temperature for women was 2.5°C higher than for men. Men had a lower body mass of fat, so it took an average longer time for metabolism. The Kangaroo Mother Care procedure, especially when done by the mother, can increase the body temperature of premature babies by conduction.

Keywords: COVID-19, Kangaroo Mother Care, premature babies, thermoregulation

Introduction

Birth weight is an indicator of neonatal life used to determine health status.[1] Some of the factors that can lead to low birth weight babies include the nutritional status of the mother during pregnancy, a body mass index (BMI) <18.5, the age of the mother being less than 20 years or more than 30.[2] The interval between births being less than 24 months.[2]

Premature babies experience an inability to maintain a normal body temperature because they lose heat four times greater than babies with sufficient birth weight, and their body's heat regulation center does not function properly.[3] They cannot adjust their body position and clothes to avoid getting cold.[3] The incidence of premature babies experiencing hypothermia was 29.1% at Hospital A in Malang City, East Java Province, Indonesia.

Globally, the number of premature births in 2018 was 20.5%.[4] In the United States, about 250,000 premature and low birth weight babies are born each year, accounting for 8.8% of births.[5] In Iran, 5,000 neonates are born daily, and about 12% are underweight.[5] Indonesia ranked fifth for the number of premature births worldwide in 2018, with a figure of 675,700, and ranked ninth for the number per live birth.[4] East Java Province has the second highest incidence of premature babies, reaching 21,544.[6] Among its cities/districts, the highest prevalence is in Jember District, with 1,887 incidents, while Mojokerto City has the lowest incidence, with 73 incidents.[6]

Premature babies born during the coronavirus disease 2019 (COVID-19) pandemic risked experiencing health problems caused by the uncontrolled coronavirus in the hospital. During the lockdown, preterm labor decreases due to social distancing restrictions which can reduce pathogenic infection.[7] Immature long-term is needed to prevent complications by maintaining body temperature, regulating and monitoring nutritional intake, preventing infection, weighing, administering oxygen, and monitoring the airway.[8] Premature babies tend to experience hypothermia, so babies need to be treated in an incubator.[9] Besides the incubator, one way to maintain the baby's body temperature stability is to give them warm blankets and hats and implement the kangaroo method.[10]

The kangaroo method is carried out by direct contact between the mother's and baby's skin to stabilize the baby's temperature and increase breastfeeding activity so that the baby's weight increases.[11] It is a free therapeutic method mothers could use at home during the COVID-

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19 pandemic.[12] Babies who receive Kangaroo Mother Care (KMC) will have a better psychological and emotional experience; with this method, the baby receives more warmth and is closer to the mother, improving the baby's quality of life.[13] This study aimed to check whether KMC increased the thermoregulation of premature infants during the COVID-19 pandemic by comparing two cases from Hospital A in Malang City, Indonesia.

Method

The study was a case report with a descriptive approach. The population was mothers with premature babies who had returned from the hospital, and the sample was taken three days after the discharge. The data were taken in December 2021 during the COVID-19 pandemic in Hospital A, Malang City, East Java Province, Indonesia. The initial sample was five, but after returning from the hospital, three babies experienced a decrease in their condition: two babies suddenly became short of breath, and one had COVID-19 symptoms.

Results

This study compared two cases from Hospital A in Malang City. Hospital A is a type A referral hospital with a higher premature birth rate than other hospitals in Malang City. The babies' and mothers' data will be shown in Table 1 and 2.

The mother of Case 1 routinely checked the pregnancy every month and planned a sectio caesarea (SC) when the baby reached a weight of 1,750 grams due to a premature rupture of membranes. The mother gave birth via SC on 25 December 2021. The baby immediately cried, breathed spontaneously, and was treated in the perinatology room for three days. The baby's body temperature was 35°C and was exposed to cold air from the fan in the room after being discharged from the hospital. The mother was given information about KMC, an alternative method of increasing premature babies' body temperature, by health workers. The mother carried out KMC so that the baby was not cold and was close to the mother (Figure 1). The KMC was given by the mother routinely every two hours for four weeks. The temperature was measured on the fourth week at 36.8°C. The baby drank formula milk every two hours (35-40 cc) because the mother was not producing breast milk. The baby had been immunized with Hb0.

The baby in Case 2 was born on 12 December 2021 via SC. The baby was the mother's second child, born 6.5 years after the first one. The baby immediately cried and breathed spontaneously after birth. However, the mother had a prenatal history of preeclampsia from the second trimester to 34 weeks of gestation. Therefore, the baby had jaundice on the third day after returning from the hospital with an indirect bilirubin level of 3 mg/dL and a direct bilirubin of 0.6 mg/dL until the tenth day and was given light therapy for seven days. Fortunately, the baby had been immunized with Hb0, and the condition improved until the indirect bilirubin level of 0.3 mg/dL and a direct bilirubin level of 0.1 mg/dL were measured. The baby was bathed by the grandmother to maintain a body temperature of 33°C. The baby shivered, the skin on the extremities of his hands and feet was cold and pale, and he often slept. Families had been given information about KMC by health workers as an alternative method of increasing the body temperature of premature babies and mentioned it was an alternative to incubators. In contrast to Case 1, the father performed KMC because the mother was undergoing independent isolation due to COVID-19 (Figure 2).

Discussion

Based on the results of the two case reports, the KMC method carried out by the mother increased the temperature of premature babies by more than 0.2°C compared

Table 1. Characteristic of the Baby

	Age*	BW/BL	APGAR Score	Gestational Age	Sex
Case 1	3 days	1,750 grams/46 cm	8	33 weeks	Female
Case 2	11 days	1,600 grams/48 cm	6	34 weeks	Male

Notes: *Age after discharge from the hospital, BW = Birth Weight, BL = Birth Length

Table 2. Characteristic of the Mother

	Age	Age When Married	Occupation	Monthly Income	Education	Pregnancy Complication
Case 1	19 years	17 years	Self-employed	IDR 4,000,000	Vocational high school	Premature rupture of membranes
Case 2	33 years	25 years	Factory worker	IDR 4,500,000	High school	Prenatal preeclampsia

Figure 1. Kangaroo Mother Care Performed by the Mother (Case 1)

Figure 2. Kangaroo Mother Care Performed by the Father (Case 2)

to the father. These results were because women have a slightly higher body temperature than men. The comfortable body temperature for women is 2.5°C higher than for men due to physical differences.[13] Men have a lower body fat percentage, so metabolism takes longer on average.[14]

Women's bodies have a higher temperature because of higher levels of brown fat, which produces heat through thermogenesis.[15] Thermoregulation occurs through the influence of thyroid hormones and the nervous system.[16] This condition affects the metabolic rate: physiologically, the human body can carry out homeostasis to maintain body temperature in the thermoregulation center, the hypothalamus.[16]

The implementation of KMC at Hospital A initially took 8-10 hours. However, during the COVID-19 pandemic, it could only be carried out in two hours due to visitor restrictions in the perinatology room. A study by Nayyar et al. also stated that during the COVID-19 pandemic, KMC was implemented for two hours, but it could be continued at home by wearing a mask.[17]

The knowledge and readiness of families of premature babies is one of the factors determining the success of implementing KMC. This condition applies to mothers and other family members, such as husbands, parents, or relatives living in the same house.[14] A previous study also stated that KMC is a life-saving intervention for neonates, as well as the cornerstone of family-centered care.[18]

During the COVID-19 pandemic, KMC was still carried out by mothers while following health protocols such as wearing masks. Considering the limited number of incubators in hospitals and many premature newborns, KMC is vitally important. Through skin-to-skin contact, it can maintain the baby's body temperature via conduction, increase the baby's attachment to its parents, stimulate the baby's suckling reflex by direct breastfeeding, and increase the baby's weight by fulfilling nutritional needs.[18] If the mother is diagnosed with COVID-19, her role can be performed by the father or other family members.[18] Families receiving information from and communicating with health workers are more motivated to continue KMC at home.[14]

Stabilizing the thermoregulation status of premature babies can reduce the occurrence of mortality.[20] Health workers should follow up on the condition of premature babies recently returned from the hospital after three days, one week, and two weeks.[21] Even after the first year of the COVID-19 pandemic, the KMC method was still taught to mothers of premature babies, who gave their newborns KMC within a few hours to improve their quality of life.

Conclusion

The KMC method can improve the temperature thermoregulation status of premature babies. However, implementing this method requires the support of all family members. If the mother cannot do KMC, other family members can, and health workers need to conduct follow-up home visits to evaluate the thermoregulatory status of premature babies.

Abbreviations

BMI: Body Mass Index; COVID-19: coronavirus disease 2019; KMC: Kangaroo Mother Care; SC: Sectio Caesarea.

Ethics Approval and Consent to Participate

The case report has gone through the research ethics committee of the Faculty of Health Sciences, Brawijaya University, No. 1659/UN10.F17104/TU/2021.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data was taken directly by the authors when following up on the condition of premature babies at home.

Authors' Contribution

ADW conceived the design of the study and finished the manuscript. YSA searched for related articles. RFPK documented the data. CPL proofreads the manuscript. REK observed and interviewed the respondents.

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Knowledge and Pattern of Preventive Behaviors Among Relatives of Breast Cancer Patients in Yogyakarta Pre and During the COVID-19 Pandemic

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Abstract

Breast cancer is still one of the leading causes of death in Indonesia. The multifactorial causes of breast cancer, including heredity, carries a risk for the sufferers' relatives. Vigilance in female relatives of breast cancer patients increases due to hereditary risk factors for having the same disease. This anthropological study aimed to reveal the mosaic of breast cancer patients' female relatives' knowledge of such a risk and their efforts to prevent it. Qualitative data collection through interviews was conducted with 13 female family members of breast cancer patients in Yogyakarta aged 17-65 years. The data analysis was done through an emic approach by examining the informants' views on the situation and their solutions. All of the informants believed that breast cancer is a malignant and deadly disease if it is not detected early and not properly treated. They were all fully aware of their risk as a family member to have the same disease. Their preventive measures included medical (early examination, breast self-examination, laboratory check, or consultation with the doctor) and non-medical (changes in eating and drinking behavior, reducing stress, exercising, and wearing masks). Besides, they also made religious efforts by praying to God to be given a healthy life and for the patients to be healed and their offspring to be free from this disease.

Keywords: breast cancer, medical, non-medical, preventive, relatives

Introduction

Cancer is one of the leading causes of death worldwide. Breast cancer is ranked tenth on the list of top causes of death in high-income countries, while its prevalence and mortality rates are also rising in Asia and Africa.[1] In the Asian context, breast cancer is often viewed as more than just a physical disease but also as attacking the survivors' mental/psychological well-being.[1] In discussing breast cancer in Asia, it is necessary to see the sociocultural values to have a more holistic picture of the disease.[1] Many studies show breast cancer brings fear, shame, or an unordinary position to breast cancer survivors.[1-3] They often lack social support from their family or society members. It makes breast cancer survivors feel they cannot openly express their fear, create awareness of the disease, or even share knowledge to prevent cancer.[1-3] Based on the Indonesian Ministry of Health data in 2022, breast cancer deaths reached 22,000 cases.[4] The highest cancer prevalence is in the Special Region of Yogyakarta Province, with 4.46 cases per 1,000 people.[5]

Heredity as a family factor is among the important causes of breast cancer, in addition to hormones, diet, work patterns, and stress. Family history is a common cause, so those who have blood relations and are of the same sex with the sufferers must be vigilant since they have higher risks of experiencing the same disease.[4] Genetic knowledge also can play out unevenly in the family. At the same time, personal relations between kin can be negotiated as "rights to know" or "not to know" about predictive heredity risk.[4] On the other hand, the family also serves as a support system for breast cancer patients by encouraging the patients to adhere to the therapy, medical treatment, and post-medical treatment and keeping the patients' emotions, feelings, and work patterns under control.[6]

During the coronavirus disease 2019 (COVID-19) pandemic, breast cancer's high morbidity and mortality caused fear and anxiety about the risk of exposure to this disease. The stress experienced by cancer patients undergoing chemotherapy during the pandemic varies from mild and severe.[7] Fear of contracting COVID-19 is influenced by increased anxiety, the type of cancer experienced, age, sex, treatment delays, hospital restrictions, fear of being alone, uncertainty about when COVID-19 will end, and lack of information on COVID-19.[8] This anxiety will affect the condition of breast cancer patients, especially in the healing process.

From the above background description, the study

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questions were as follows: how are the family members' knowledge and acceptance of the breast cancer suffered by their family members? What do female family members of breast cancer patients do to prevent the possibility of developing breast cancer? This medical anthropological study was expected to provide a clear picture of family members' knowledge and preventive efforts that can be disseminated to the general public to increase breast cancer awareness. This study explored knowledge about the warning signs, prevention of breast cancer, and its determinants among the family members in Yogyakarta.

A recent study on breast cancer showed that how people make sense of living with breast cancer is shaped by the social and cultural contexts in which they live, including how women perceive, cope with, understand, and experience their disease.[9] This narrative was also raised by Kleinman,[10] who argued that understanding how breast cancer patients evaluate their illness is crucial for physicians to provide effective, empathic, and ethnically sensitive health care. The patients' interactions in their social environment and social and economic conditions inform how they make sense of their illness and shape their illness narratives.

In many cases, people with breast cancer choose treatment from traditional healers.[11] Many women in Asia, including Indonesia, believe in the influence of factors beyond human power, driving them to visit traditional or spiritual healers, despite the availability of modern medical care.[12] In this sense, the variation in religious and cultural practices and lifestyles shapes different reactions to breast cancer between ethnic groups of Asia. One study comparing Chinese and Malay cultures showed that the incidence of breast cancer among Chinese women is higher, but the mortality rate is lower than among the Malays.[1] Fear, fatalism, and family values strongly influenced Malaysian women's reactions to their illnesses.[1]

In Indonesia, cultural factors became significant problems for breast cancer patients. These include aesthetic concerns about loss of beauty with the corresponding fear of being left by the spouse. This condition often triggers inappropriate and overly aggressive use of alternative drugs.[13] Some of these treatments may not match their subjective expectations or informed preferences and are associated with poorer quality of life, shorter survival, regret, and in some cases, severe financial hardship.[14] Treatment delays often happen due to psychological, economic, cultural, mythical, and health service factors.[11] This study tried to understand how cultural aspects influenced breast cancer understanding and preventive behavior.

Method

This study used ethnography methods to gather data on the family member informants' experiences treating breast cancer patients. An emic approach was used to understand the informants' perceptions regarding their situation and how they solved the problems. In practice, it was not easy to find family members who could tell about their experience in treating breast cancer patients, especially if the patients died due to their cancers.

Snowball sampling was used to find 13 cases of female relatives of people with breast cancer willing to participate in the study. The familial relations were as a daughter (7), mother (2), elder sister (1), younger sister (1), and daughter-in-law (2) of the breast cancer patients. All informants had come to terms with the condition of having a family member who had breast cancer, including those whose family members died from the disease. They were Javanese aged 17-41 years (young group) and 41-65 years (old group), 11 people were Islam, and 2 were Christian. The participants were obtained from (1) the Indonesian Cancer Foundation in Sleman, which receives breast cancer patients from outside Yogyakarta; (2) the Yogyakarta branch of the Breast Cancer Survivor Association; (3) the institutions/universities where the authors work; and (4) the authors' relatives who gave information about people with breast cancer in their neighborhoods.

The first period of interviews and observation was conducted from July to September 2019 in the informants' house, neighborhood, or Cancer foundation to understand the informants' socioeconomic, living conditions, and expressions during the interviews. The second period was from January to March 2023 to understand the relevance of the COVID-19 pandemic to the informants' conditions. The collected data were categorized thematically, and then the data analysis and interpretation process was carried out. Then, conclusions were drawn based on the results of the analysis and interpretation.

Results

Knowledge and Experience in Caring for Breast Cancer Patients

The breast cancer patients in this study were members of the informants' nuclear family or extended family. The observation results from 13 informants showed that sadness still hangs over their hearts when talking about the condition of breast cancer relatives, especially during the pandemic, when the stress experienced increased. Although their words were optimistic, anxiety always appeared on their face.

The calamity experienced by their family members was accepted with sincere patience and resignation. They thought their family's breast cancer could be caused by many factors, such as heredity, hormones, frequent consumption of instant/canned foods or foods containing preservatives, stress, and a poor environment. They could not say with certainty which factors triggered breast can-

cer suffered by their family members.

Some informants mentioned that the patients liked instant foods or foods containing preservatives. At the same time, some said that their family members still got breast cancer despite their "clean" lifestyle in which they consumed a healthy diet. Heredity and hormonal factors were believed by most of them to cause breast cancer because they found other family members with the same health problems.

All informants believed breast cancer is a dangerous disease often considered malignant. It was because the disease can metastasize, spreading throughout the body. Therefore, although breast cancer has been removed through surgery, the metastatic phase will likely progress if the patient is not routinely checked and treated accordingly. Patients with metastases experienced grave suffering because they could not function normally due to the pain and insomnia they experienced. They could not do their daily activities properly, especially lifting heavy loads; many must lie in bed constantly.

> *"My mother had to lie in bed most of the time before she eventually passed away. Although her cancer had been removed by surgery, she still suffered from other symptoms such as stroke and increased stomach acid and blood sugar. The doctor said that her cancer metastasized to her brain too."* (ST, 27 years)

Almost all informants said that the most suitable treatment for breast cancer was modern medical treatment because it was equipped with modern medical equipment and appropriate medications. However, the patients will feel the after-therapeutic effects, such as weakness, loss of appetite, nausea, and dizziness. While, the family must be prepared to handle the patient's condition and domestic work.

Preventive Efforts

The important role played by heredity as a contributing cause of breast cancer raised awareness on the part of patients' relatives to think about their risk of developing the same disease. Many family members learned from the doctors who treated the patients that the heredity factor should be considered seriously. Those who were the direct descendants of the patients become aware that they have the potential to develop the same disease. One example of this awareness could be seen in the response of SM (31 years), a younger sister of a breast cancer patient, who had her breasts examined at the hospital upon finding a lump in her breast through breast self-examination. As close relatives of breast cancer patients, the informants received vital information from various media or doctors' explanations when they accompanied the patients. The awareness that prevention is better than curation was deeply instilled in them.

The informants chose the easiest and lowest-cost preventive efforts, such as avoiding fried, fatty, instant, and roasted foods or drinks containing preservatives. Although they sometimes found it challenging, they chose this method given the risk they faced. Morning exercise was routinely performed no matter how busy they were. Walking, swimming, or elderly exercises were chosen by the 13 informants to lessen the risk of developing breast cancer. Furthermore, two informants ST (27 years) and H (36 years), practiced wearing masks and avoiding cigarette smoke because they believed environmental factors also contributed to the disease. Healthy foods like vegetables and fruits were chosen. Despite its simplicity, this method was hoped to prevent cancer effectively. A young informant (NM, 17 years) chose a very comprehensive method to prevent breast cancer, as indicated by the following statement.

> *"Preventive efforts are quite easy: live a healthy life, not hold bad feelings inside, be happy, build open communication, develop a hobby, avoid stress, keep your emotions under control, and understand your body."*

The lives of Javanese people filled with Javanese values and philosophies made the informants base their mindsets on knowledge and God as the creator and helper of humans. They believe that health, illness, disease, suffering, and healing are in God's hands. Doctors, health workers, and traditional medicine merely serve as healing intermediaries. All informants also made spiritual efforts according to the religion they professed. They asked for healing for their family members who had breast cancer through prayers or by engaging in religious rituals to attain calm and peaceful feelings. They also prayed for freedom from this disease for themselves.

> *"My mother's condition improved due to the help of the church community and her activities as a survivor."* (NM, 17 years).

Discussion

Indonesia has no particular breast cancer preventive program except through SADARI (check your breast).[14,21] Breast cancer patients experience many difficulties related to healing under normal conditions. The problems have increased during the COVID-19 pandemic. Cancer patients experience many stressors related to the COVID-19 pandemic associated with psychological symptoms.[15] However, all of the breast cancer patients' family member informants from the Javanese culture tended to accept the suffering of their family members as part of God's plan. They believed that disease and illness are trials from God and thus surrender to God's will. Despite their resignation, patience, and acceptance of their family member's illness, they were always optimistic that, somehow, it would be healed. They continued to

strive, seek, and look for the best ways to cure cancer for patients.

The informants' knowledge about cancer was quite adequate in the sense that informants know and understand the biological and non-biological factors that cause breast cancer. They came from a city background and higher education. The informants in this category tended to interact more intensely with the doctors and medical personnel who cared for the patients to increase their knowledge. Besides, many also seek information from other sources, including the Internet or other family members, during patients' therapy at the hospital. Most patients' families were knowledgeable about the treatments that can be used to deal with breast cancer, such as surgery, radiation, and chemotherapy.[16] They had an adequate understanding of their effects.[17]

Breast cancer patients' relatives took two main ways to lessen the patients' suffering. First, by providing moral support, including showing enthusiasm, motivation, attention, and affection; being available for patient care; accompanying patients during their treatment/therapy. Second, assisting patients with activities of daily living where they need help from others. Breast cancer patients need social support to keep them enthusiastic about dealing with their health conditions.[16,18] Moral support is considered the most important assistance to deal with the illness. With such support, patients gradually become enthusiastic again to live their lives, undergoing surgery, chemotherapy, radiation, and other medical treatments. In this case, family and peer support can be seen as the "social glue" of connectedness that binds the survivors together and provides mutual solidarity, which gives a social opportunity that is helpful to health improvement.[19]

Hopefully, these conditions will recover quickly during the COVID-19 pandemic so that breast cancer patients can be assured of the healing process, medically and non-medically. Another important lesson from breast cancer patients pre and during the pandemic is that prevention is better than cure. A healthy lifestyle and avoiding risk factors should be a trend in the community to prevent stress and other life pressures.

The informants' preventive measures to avoid breast cancer were divided into two efforts. First, using medical methods, including medical examination, lab checking, therapy, and consultation with doctors. One of the informants had her breast laboratory results checked and consulted with a doctor. However, this was not the first choice to prevent breast cancer because medical efforts were considered scary and expensive. Medical methods were believed to be the best, but not all informants feel the importance and urgency to use them as they think breast cancer is still a mystery and the exact cause is unknown. Its multifactorial causes made the informants unable to decide the most appropriate preventive measures confidently.[11]

A previous study stated a disconnection between what is already discovered and what needs to be delivered in cancer care.[20] In contrast, the size of the gaps in good access to care, prevention, and early detection of cancer remain salient issues to tackle cancer better and identify under-diagnosed and untreated persons.[20] Many informants chose to do breast self-examination as this method is considered easy, at no cost, and not scary. Lay people can practice breast self-examination to feel a lump in their breasts.[21]

The second method was non-medical efforts by changing their behavior to a healthy lifestyle. This method is often called complementary therapy because it complements the medical methods. The results of interviews and observation showed many informants felt shy and afraid to use medical methods, and non-medical methods often became the first choice. Furthermore, interviews and observation also showed all informants' changes in behavior, including avoiding food/drinks containing preservations, roasted food, cigarette smoking, excessive alcohol consumption, or life pressures/stress. This healthy lifestyle also translated into spiritual actions in the form of religious rituals and acceptance of breast cancer as fate and trials from God.

There were differences in the prevention efforts made by young and old informants. Young informants were exposed to more information to make their efforts more apparent. They were also very enthusiastic about their preventive efforts. As for their older counterparts, they looked more passively because they thought that with their old age, their risk of developing breast cancer was low. Even if they change their behaviors, they tend to do them with low enthusiasm. This study only involved the informant from Javanese ethnicity with Islam and Christian backgrounds. For further studies, it is necessary to look at other ethnic backgrounds and different religious backgrounds to understand the spiritual aspects of breast cancer.

Conclusion

This study seeks to understand more about the spiritual aspects of breast cancer through how cultural factors and norms in Javanese society influence people's understanding of cancer. The study results show that after intensive assistance to patients, breast cancer is not only believed to be a disease caused by biological (hereditary factors) and non-biological factors but instead by spiritual aspects, like destiny or trials given by God, which influence the preventive measures taken by breast cancer patient assistance. They combine medical efforts, lifestyle changes, and spiritual prevention.

Abbreviations

COVID-19: Coronavirus Disease 2019.

Ethics Approval and Consent to Participate

The study has been carried out following research ethics rules and has been approved by the ethics commission of Universitas Gadjah Mada, No. 349/UN1.FIB/UP2M/2022.

Competing Interest

The manuscript has never been published in any other journal. The authors agree to follow the journal's submission instructions.

Availability of Data and Materials

This study is based on ethnographic field research. It followed the ethical guidelines of the Universitas Gadjah Mada for social and cultural research. Because of our responsibility for safeguarding the participants' identity, following Privacy Legislation and Data Protection Laws, the ethnographic material cannot be made public in its raw and unprocessed form, such as field notes. The ethnographic data is stored on a password-protected computer, while this folder's backup is kept on a password-secured external hard drive. The data have not been deposited in a repository since they contain private and sensitive information about breast cancer patients and their families. Access to the field site and ethnographic information has been permitted solely for the principal researcher and not for any other parties.

Authors' Contribution

AT and RM participated in the field and writing process. AT significantly contributes to methods, results and discussion; meanwhile, RM significantly contributes to the introduction, discussion, and conclusion. AT and RM are responsible for the subsequent revision, proofreading, and discussion with reviewers. Before submission, all undersigned authors have read and agreed on the manuscript's content.

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Workers' Characteristics of Hearing Loss at Soekarno-Hatta International Airport, Indonesia

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Abstract

This study aimed to analyze the characteristics and factors of worker behavior, including age, the use of ear protection, work duration, a history of diabetes mellitus or hypertension, work rotation, and noise hazards involved in hearing loss in PT. X at Soekarno-Hatta International Airport, Indonesia. A cross-sectional study from May 2017 to June 2017 involved 73 workers in the power service area (TZ Unit) exposed to noise levels <85 dBA and ≥85 dBA, using an audiometry test for hearing loss and Sound Level Meter for noise hazards was conducted. The Chi-square test showed a significant correlation between age (OR 8.4, 95% CI = 1.6–44.1), work duration (OR 7.6, 95% CI = 0.9–67.2), and the use of ear protection (OR 7.8, 95% CI = 1.4–44.2) with hearing loss in workers in the power service area. The multivariate analysis revealed that workers exposed to a noise level of 85 dBA had a 1.7 times greater risk of hearing loss than workers exposed to a noise level of <85 dBA after controlling for age, work duration, use of ear protection, medical history, and work rotation.

Keywords: airport, hearing loss, noise, workers

Introduction

Hearing loss incidence is a serious problem globally. In 2018, the World Health Organization suggested that more than 466 million people worldwide were living with disabling hearing loss.[1] It is estimated that the number will increase to 630 million by 2030 and surpass 900 million by 2050.[2] Among the regions, Southeast Asia had the second-largest number of people with moderate to profound hearing loss, with an estimated 103.4 million people in 2019.[3] While, the estimated prevalence of hearing loss in Indonesia was 4.2%, affecting about 9 million people across all age groups.[4]

Loud noise is a physical pollutant that can become an environmental health problem and can cause health problems, especially hearing loss, if its intensity exceeds a threshold value.[5] Loud noise negatively impacts industries and workers.[6] The non-auditory noise impacts are stress, impaired communication, reduced concentration, and decreased work productivity.[7] Hearing loss prevalence in the group of workers exposed to a noise level of >85 dBA was higher than in the general population.[5] A study on the aircraft maintenance, repair, and overhaul (MRO) industry in Saudi Arabia showed that of the 200 workers exposed to noise levels of 89.3-93.4 dBA for 8 hours per day, 32.5% experienced hearing loss due to the noise.[8]

Based on the Regulation of the Indonesian Ministry of Manpower and Transmigration No. PER.13/MEN/X/2011, a noise threshold value (NAV) is set to 1 to 8 hours daily for noise intensity between 85 and 94 dBA.[9] However, one area where the threshold value is often exceeded is the airport area.[10] PT. X at Soekarno Hatta International Airport, Indonesia, provides aircraft maintenance services for various types of airlines and is one of Asia's largest international aircraft maintenance facilities. It has four hangars with an area of 972,123 m^2. Aircraft maintenance services provided by PT. X include line maintenance, base maintenance, component maintenance, engineering service, material service, engine maintenance, and power service.

During aircraft maintenance, PT. X uses machines and mechanical equipment that produce noise with fairly high intensity. Previous measurements conducted by PT. X show that the power service area (TZ Unit) has the highest noise level compared with other work areas, which comes from work activities such as welding, dressing, machining lathe work, plasma coating, and indoor high-velocity oxygen fuel (HVOF) coating. If the noise intensity is not handled properly, it will pose a risk to human health (auditory or non-auditory disturbances).

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Thus, this study aimed to analyze the characteristics and factors of worker behavior, such as age, the use of ear protection, work duration, a history of diabetes mellitus or hypertension, work rotation, involved in noise hazards with hearing loss in PT. X workers at Soekarno Hatta International Airport.

Method

This study used a cross-sectional quantitative method conducted at PT. X from May to June 2017. The criteria for workers to be included in this study were (a) working in the sample point production unit, (b) having a healthy physical condition, and (c) actively working at the time this research was conducted. Excluded from this study if the workers were (a) foreign employees or expatriates, (b) respondents who refused to be sampled, (c) respondents who were not working or who were on leave at the time the study was conducted, and (d) respondents who were not available at the time the study was conducted.

The study population consisted of all workers at PT. X in the power service area (TZ Unit), specifically in the office and non-office areas around the TZP-3 unit, totaling 78 people (morning and evening shifts). The number of samples in this study was determined based on the two-sided hypothesis formula for population proportions. However, only 73 people could be used as samples because five workers were absent. The participants who met the inclusion criteria were workers working in the sample point work area at PT. X. The TZ Unit was chosen because it has the highest noise level compared with other work areas at PT. X.

The noise intensity level was measured with a calibrated sound level meter (SLM) type SD-200 produced by 3M. The measurements were taken at 39 area points, of which 32 were non-office points, and 7 were points at the TZP-3 Unit office. Each point was measured for 10 minutes, automatically displaying the L equivalent result (average value) in dBA and providing information on the area's minimum and maximum noise values.

The audiometric examination used a calibrated Interacoustics AD-226 audiometer. The measurements used the American National Standard Institute (ANSI) S3.1-1999 as a reference. In addition, the data collection about the influence of workers' characteristics and behavior on the impact of noise was done by filling out a questionnaire based on a ten-minute interview held by the authors to obtain information/data from the participants. The attached data from the questionnaire includes age, the use of ear protection as personal protective equipment (PPE), work duration, history of diabetes mellitus (DM) or hypertension, and work rotation.

Results

Analysis showed no statistically significant correlation (p-value = 0.233) between a noise level of ≥85 dBA and hearing loss in workers. The odds ratio (OR) value showed that workers exposed to noise levels of <85 dBA had a 0.2 times greater risk of experiencing hearing loss than workers exposed to noise levels of ≥85 dBA. While, workers' age and hearing loss showed a statistically significant correlation (p-value = 0.016). The OR value indicated that workers aged ≥40 years had an 8.4 times greater risk of experiencing hearing loss than workers aged <40 years.

Analysis of workers' work duration and hearing loss showed a statistically significant correlation (p-value = 0.05) between the two variables. The OR value indicated that workers working for ≥4 years had a 7.6 times greater risk of experiencing hearing loss than those working for <4 years (Table 1). The frequency of using PPE showed a statistically significant correlation (p-value = 0.018) with hearing loss. The OR value showed that

Table 1. Characteristics, Noise Level, and Hearing Loss of Workers at PT. X

Variable	Category	Hearing Loss				Total	OR (95% CI)	p-value
		Yes		No				
		n	%	n	%			
Noise level	≥85 dBA	2	5.0	38	95.0	40	0.2 (0.1–1.6)	0.233
	<85 dBA	5	15.2	28	84.8	33		
Age	≥40 years	4	30.8	9	69.2	13	8.4 (1.6–44.1)	0.016
	<40 years	3	5.0	57	95.0	60		
Work duration	≥4 years	6	17.1	29	82.9	35	7.6 (0.9–77.2)	0.05
	<4 years	1	2.6	37	97.3	38		
Use of PPE	No	5	23.8	16	76.2	21	7.8 (1.4–44.2)	0.018
	Yes	2	3.8	50	96.2	52		
Work rotation	No	4	16.0	21	84.0	25	2.9 (0.6–14.0)	0.222
	Yes	3	6.3	45	93.8	48		
Record of DM and hypertension	Yes	2	40.0	3	60.0	5	8.4 (1.1–62.5)	0.069
	No	5	7.4	63	92.6	68		

Notes: OR = Odd Ratio, CI = Confdence Interval, PPE = Personal Protective Equipment, DM = Diabetes Mellitus

workers who did not wear ear PPE had a 7.8 times greater risk of experiencing hearing loss than workers who used PPE (Table 1).

The variables of work rotation and hearing loss showed no statistically significant correlation (p-value = 0.222) between each other. The OR value showed that workers who did not do job rotation had a 2.9 times greater risk of experiencing hearing loss than those who did (Table 1). Table 1 also shows no statistically significant correlation (p-value = 0.069) between a DM or hypertension history and hearing loss in workers. The OR value indicated that workers with a history of DM or hypertension had an 8.4 times greater risk of experiencing hearing loss than workers with no history of DM or hypertension.

Two methods were used to build a multivariate model. The first method was a scientific approach, and the second evaluated the p-values (<0.25). However, when the selection was made, a variable with a p-value of >0.25 will likely be filtered out of the multivariate model, although it could be that the variable interacts with the dependent variable. The multivariate model consisted of six independent variables: noise level, use of PPE, work duration, age, work rotation, and history of DM or hypertension.

The final analysis model (Table 2) contained two main independent variables: noise level and confounding variables, such as age, work duration, use of PPE, a history of DM or hypertension, and work rotation. After the final model was obtained, the interactions between the noise level and work rotation, the use of PPE and work duration, and work rotation and the use of PPE were analyzed.

These analyses were done because these variables may interact, but after analyzing the model, it was found that they had no interactions. The analysis results revealed that workers who worked in areas with noise levels of ≥85 dBA had a 1.7 times greater risk of experiencing hearing loss than those who worked in areas with noise levels of <85 dBA, after controlling for age, work duration, use of PPE, a record of DM or hypertension, and work rotation.

Table 2. Final Model

Independent Variable	OR	95% CI	p-value
Noise level	1.7	0.1–21.5	0.701
Use of PPE	4.8	0.4–61.5	0.228
Work duration	4.2	0.4–47.9	0.246
Age	3.4	0.3–39.2	0.333
Work rotation	3.5	0.5–24.4	0.2
Record of DM or hypertension	1.1	0.1–17.8	0.973

Notes: OR = Odd Ratio, CI = Confdence Interval, PPE = Personal Protective Equipment, DM = Diabetes Mellitus

Discussion

Noise and Hearing Loss

The results showed no significant correlation between noise level and hearing loss. The results also revealed that 71.2% of workers in the Power Service Area used PPE during work, meaning that many, but not all, workers were aware that protecting themselves from noise hazards is important. Based on observations, the workers were informed about health and safety every day before work started. This habit was useful in increasing workers' knowledge of various hazards in the workplace, including the dangers of noise. Therefore, workers became well-educated and aware of using PPE to minimize noise hazards. The PPE used in the Power Service Area was the 3M Ultrafit Earplug, with a noise reduction of up to 25 dBA when used according to the instructions. In addition to earplugs, the 3M Optime 105 Earmuffs, with a noise reduction of up to 30 dBA, were used as instructed.

Age and Hearing Loss

The analysis results showed that the average age of workers in the PT. X Power Service Area in the TZP-3 Unit was 29.5 years. In addition to a significant correlation between age and hearing loss, the OR value indicated that workers in the Power Service Area aged ≥40 years had an 8.4 times greater risk of experiencing hearing loss than workers aged <40 years. This result was in line with a study on the metal workshop, which showed a significantly higher risk of hearing loss among workers aged 45-66 years (AOR = 3.8; 95% CI = 1.5–9.5) compared to workers less than 30 years old.[11] Further, a study in the palm oil mills also showed that older age is a significant factor associated with hearing loss among noise-exposed workers (p-value = 0.001).[12]

In addition, hearing function will gradually and progressively decline with age. A study by the Indonesian Ministry of Health stated that people aged ≥40 years are more susceptible to hearing loss due to noise because of the gradual and progressive age-related decline in hearing function.[13] It is known from the previous study by Wattamwar, *et al.*, that hearing loss naturally occurs with the increase of age due to a worsening in the hearing threshold.[14]

As age increases and cannot be controlled, a set retirement age limit is necessary. As regulated in the Regulation of the Minister of Manpower and Transmigration Number 29 of 2015, the retirement age was 57 years in 2015.[15] With this age limit, workers who have reached retirement age and experience much physical decline no longer have to be exposed to physical and mental harmful environmental conditions and can enjoy old age with the social security that the company pro-

vides.[16]

Work Duration and Hearing Loss

This study's results showed that of the 73 respondents, 38 people (52.1%) have worked in the Power Service Area for less than four years, and 35 people (47.9%) for more than four years. In addition to a significant correlation between work duration and hearing loss, the OR value indicated that workers in the power service area with a work duration of ≥4 years had a 7.6 times greater risk of experiencing hearing loss than workers with a work duration of <4 years. This result was in line with a study on workers at a textile mill in Myanmar, which showed a significantly higher risk (OR = 6.07; 95% CI = 2.9–12.3) on workers with longer work duration.[17] A study of Malaysian airport also showed a significant correlation between a work duration of more than four years and hearing loss (OR = 2.1; 95% Cl = 1.4–4.7).[18]

According to the Encyclopedia of Occupational Health & Safety, hearing loss due to noise will be seen in a person after working in a noisy environment for approximately 3-4 years.[18] Another study also explains that long working hours in noisy places, such as airports, seaports, and construction sites, lead to a high risk of hearing loss after working for 2-4 years.[10] The longer the working period, the greater the risk of hearing loss.

Most employees (52.1%) working for less than four years were mechanics with an outsourcing status, who most likely would move jobs when their contract expired; therefore, the turnover rate for new workers was relatively high. They worked in the power service area for about 1 to 9 months. On the other hand, some workers were known to have worked for >10 years because most PT. X employees used to work for the parent company of PT. X.

Use of Personal Protective Equipment and Hearing Loss

Of the 73 respondents, 52 (71.2%) used PPE during work, and 21 (28.8%) did not. Some employees worked indoors or in the office, so PPE was not mandatory for them. However, based on observations, many employees did not use PPE when they went to the field or noisy areas because they stayed there for only a short time (15-30 minutes). The statistical analysis results showed a statistically significant correlation between the frequency of using PPE and hearing loss in workers. A previous study supports this result, showing a correlation between industrial workers exposed to noise but did not use PPE and hearing loss (p-value = 0.002).[19] Also, this study revealed that workers who did not use PPE had a 3.35 times greater hearing loss risk than those who did. A study by Puspitasari, too, showed that people who did not use PPE at work were 2.27 times more likely to develop hearing loss than those who did.[20]

In addition to a significant correlation between the use of PPE and hearing loss, the OR value indicated that workers in the power service area who did not wear PPE had a 7.8 times greater risk of experiencing hearing loss than those who did. Regarding the type of ear protection used in the power service area, 54.8% of workers used earplugs, and 16.4% used earplugs and earmuffs. Many workers use earplugs because, technically, earplugs are used in places with low-frequency noise, such as welding and dressing work areas. Earplugs are made from various materials, such as PVC foam, polyurethane, polyethylene, and silicone.[21] Functionally, earplugs can reduce noise by 8-30 dBA and are used for ear protection at noise levels of up to 100 dBA.[21]

PPE replacement in PT. X has not been mandated. Hence, the workers must wait for new PPE until it is damaged or lost. However, 32.1% of workers replaced their PPE every month by themselves, and 30.2% used their PPE until it was damaged, after which they returned it. Ideally, the power service area earplugs should be replaced every 2-3 months, depending on the type and environment.[22,23] Earplugs should be replaced immediately if they shrink, enlarge, harden, weaken, or tear.[24] Ideally, earmuffs should be replaced at least once a year or when the earmuffs have become stiff and cracked.[24]

Based on observations, many earplugs were often lost in the power service area, so workers often replaced them within one month. PPE can be damaged over time, especially the seal section. It will harden and not function effectively, thus not protecting the hearing organ optimally from noise. Integrated health care should be available not only in occupational situations but also in environmental health settings.[25]

Conclusion

There was a significant correlation between age, work duration, and the use of ear protection devices (PPE) with hearing loss in workers in the power service area. Workers exposed to a noise level of ≥85 dBA had a 1.7 times greater risk of hearing loss than workers exposed to a <85 dBA after controlling for age, work duration, use of PPE, medical record, and job rotation.

Abbreviations

MRO: Maintenance, Repair, and Overhaul; PPE: Personal Protective Equipment; DM: Diabetes Mellitus.

Ethics Approval and Consent to Participate

The study was conducted following the Declaration of Helsinki and approved by the Ethics Commission for Health Research, Faculty of Public Health, Universitas Indonesia (license Number 280/UN2.F10/PPM.00.02/2017 obtained from the institution for the research project).

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and information used as study materials can be obtained from the corresponding author upon reasonable request.

Authors' Contribution

RAW was responsible for creating the ideas, conducting the analysis, and preparing the manuscript. AET performed the formal analysis, conducted the investigation, interpreted the results, and wrote the original draft. BH supervised the study, wrote the review, and edited the text. All authors were involved in conceptualization, methodology, software, validation, resources, data curation, review writing, and editing. All authors have made substantial contributions to the final manuscript for publication.

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Access to Social Media, Knowledge, and Acceptance of COVID-19 Post-Vaccination Health Protocols: A Cross-Sectional Study

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Abstract

The health protocols recommended by the health authorities still need to be practiced after having the COVID-19 vaccine. Education on the prevention of COVID-19 infection needs to continue to protect people from the disease. This study aimed to determine the factors associated with adhering to COVID-19 post-vaccination health protocols in people aged 18 years and over in the South Denpasar Subdistrict. This cross-sectional study comprised a sample of 147 people who were selected by incidental sampling. The data were obtained using questionnaires from July to August 2022 and examined with bivariate and multivariate analysis. Most participants were female, private employees, went to senior high school, accessed social media, had high knowledge of COVID-19, and properly followed health protocols post-vaccination. However, only 34.7% of participants accepted the government's policy for preventing COVID-19. Multivariate analysis showed that good social media access (aOR = 11.9; 95% CI = 3.6–39.8; p-value<0.001), high knowledge of COVID-19 infection (aOR = 2.6; 95% CI = 1.0–7.4; p-value = 0.044) and high acceptance of government policies (aOR = 4.1; 95% CI = 1.5–11.6; p-value = 0.006) were associated with the application of health protocols post-vaccination in people aged 18 years and over. In the studied group, having access to trusted social media, knowledge, and public acceptance of government policies led to adhering to the recommended health protocols post-vaccination.

Keywords: acceptance, COVID-19, health protocols, knowledge, social media access

Introduction

The pandemic of the coronavirus disease 2019 (COVID-19) is one of the biggest public health problems globally. It is disrupting the health system worldwide, leading to millions of deaths.[1] COVID-19 is caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection.[2] Before the COVID-19 vaccine was developed, the health prevention strategy for preventing COVID-19 infection was the implementation of health protocols. In the post-COVID-19 vaccination era, the health authorities have advised people to continue adhering to the health protocols, particularly those without the COVID-19 vaccination booster.[3] This is because the effectiveness of the COVID-19 vaccine decreases from 88% during the first month after complete vaccination to 47% after five months.[4] Even vaccinated individuals are still at risk of contracting the virus.[5] Therefore, in the post-vaccination era, the risk of individuals who have received complete vaccination catching COVID-19 must be conveyed to the public because vaccinated individuals tend to change their behavior.[6] A decrease in adherence to health protocols after vaccination makes individuals more susceptible to transmitting the COVID-19 virus.[7]

As well as carrying out vaccinations to achieve herd immunity, the health services should remind the public to consistently follow health protocols through health promotion.[8] Health promotion related to COVID-19 must continue to remind the public to be disciplined in following the health protocols.[9] Post-vaccination education is very important because if the community considers that health protocols are no longer needed, it will reduce its compliance with the protocols.[10] Education can be provided by health workers because they are the most trusted source of health information.[10] A post-vaccination study proves that individuals who have received the vaccine are less likely to follow the recommendation to keep their distance from others.[11] Another study found that after vaccination, 10.6% of respondents did not adhere to wearing masks, 22.4% did not regularly wash their hands, and 43.5% did not socially distance.[12]

Social media tends to be effective for education because it provides interesting information.[13] A study by the World Health Organization (WHO), United Nations Children's Fund (UNICEF), and Indonesian Ministry of

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Health found that around 54% of respondents use online applications such as WhatsApp, Facebook, Instagram, and Twitter to get information about COVID-19.[14] Social media can have a positive impact on protecting the public from the COVID-19 pandemic.[15] The full impact of social media in preventing COVID-19 infection has not yet been measured.[16] An analysis of the role of social media needs to be done to improve and develop its role in providing education so that people's consistency in following health protocols post-vaccination is maintained.[17] The integrated model developed by Al-Dmour, *et al*., can be used to measure the impact of social media on public acceptance. It adopts the Health Belief Model (HBM), stating that social media intervention is a strategy to increase knowledge, change behavior, and form a public health protection system against COVID-19.[15]

The Primary Health Care (PHC) III in South Denpasar has conducted a health education campaign on preventing COVID-19 using social media such as Instagram, Facebook, and Whatsapp Groups.[18] The campaign aims to promote adherence to the health protocols even after getting a vaccination booster. The educational materials on its social media include health protocols for domestic travelers and hotlines for vaccination, diarrhea due to COVID, implementing balanced nutrition to prevent COVID, and the vaccination procedure for the elderly.[19]

Other educational materials produced include "Together against COVID-19," a tutorial on how to download vaccination certificates, information on vaccination for survivors of COVID-19, information on adverse events following immunization (AEFI), a WhatsApp Cares chatbot, information on the COVID-19 Omicron variant, and COVID information for children aged 6–11 years and the elderly.[20] It is important to promote community awareness of the spread of COVID-19 and to optimize the community's acceptance of health protocols after having the COVID-19 vaccination booster. Thus, this study aimed to determine the factors influencing adherence to health protocols post-COVID-19 vaccination in people aged 18 years and over in the South Denpasar Subdistrict.

Method

This observational study used a cross-sectional design and was conducted in the PHC III of South Denpasar Subdistrict from July to August 2022. This study employed an incidental sampling from 311,590 people. The South Denpasar Subdistrict is an urban area and one of the most congested areas in Denpasar City, with an area of 4.999 ha or 39.1% of the total. The inclusion criteria for this study were having had a booster vaccination and living in the South Denpasar Subdistrict. The minimum sample of 147 people was calculated using two different hypothesis tests for the WHO standard proportion with a P1 value (the proportion of people who followed the health program from the previous study) = 10.6%.[21] The value of P2 (the proportion of people who do not comply with the health program from the previous study) = 23.5%, the study power was 80%, and the alpha value was 0.05.

The study's dependent variable was the acceptance of the health protocols, and the independent variables were the characteristics of the respondents, including age, sex, education, occupation, and COVID vaccination status. Furthermore, the social media access variable included community behavior in accessing social media, Facebook, Instagram, and WhatsApp groups by reading the information provided on such topics as the COVID-19 disease, the 5M health protocol (washing hands, maintaining distance, staying away from crowds, reducing travel, and wearing masks), and COVID-19 vaccination.[22] Each respondent's knowledge of COVID-19 disease was measured by 15 questions that included the causes of the disease, modes of transmission, signs and symptoms, risk factors, and efforts to prevent and control COVID-19. The respondent's knowledge was categorized as high for scores more than and equal to 90% correct answers, while scores of less than 90% were categorized as low.

Furthermore, six questions were used to measure the community acceptance of COVID-19 protocols, which consisted of whether the respondent believed that health protocols could prevent the spread of the virus; whether government policies can control COVID-19; whether COVID-19 infection can be prevented by wearing masks, washing hands, and maintaining distance; and whether they accepted government policies related to COVID-19 (implementation of health protocols, testing and tracing policies, and booster vaccinations). The community acceptance was categorized as high and low; "high" when 90% or more of the questions were answered positively and "low" when less than 90% were answered positively.

The study's independent variable was the respondent's compliance with health protocols to prevent COVID-19. Seven questions were used to measure compliance, which included following health protocols, adhering to government recommendations, and participating in community protection efforts. Compliance with health protocols was categorized as good if 90% or more of the questions were answered "yes," and bad if less than 90% were answered "yes." All variables were obtained through interviews with the respondents using a structured questionnaire.

The data were processed using the free version of SPSS 25. Univariate analyses were done to measure the frequency of the characteristics and all variables, e.g., social media access, community knowledge, community ac-

ceptance, and adherence to health protocols. Inferential analysis was used to measure the difference in proportion between the independent and dependent variables. Hypothesis testing was conducted with the Chi-squared method with a 95% confidence interval and multiple logistic regression tests using the backward method to determine the relationship between access to social media, public knowledge, and public acceptance of the government's health protocols.

Results

The final analysis included 147 respondents. Most respondents were female adults (63.3% female, 76.9% adults), had been to high school (66%), worked as private employees (54.5%), and had had the COVID-19 booster vaccination (75.5%) (Table 1). Less than half of the respondents (46.3%) had sufficient access to social media; most of those used Facebook. Most respondents did not use social media daily, had accessed it in the last six months, enjoyed reading information about COVID-19, practiced the COVID-19 prevention program, had been vaccinated, and provided feedback by liking and sharing information with friends and family. Most respondents (80%) were categorized as having high knowledge regarding the dangers of COVID-19 infection. However, only 34.7% highly accepted the government's policy for preventing COVID-19. 70.1% followed good health protocols (Table 2).

Table 3 shows the significant proportion differences in following health protocols based on access to social media, public knowledge, and public acceptance. An overwhelming 86.5% of people who accessed social media related to COVID-19 education, 73.9% who had high knowledge regarding the dangers of COVID-19, and

Table 1. Respondents' Characteristics (n = 147)

Variable	Category	n (%)
Age (years)	Teenagers (18–20)	32 (21.8)
	Adults (21–60)	113 (76.9)
	Elderly (>60)	2 (1.4)
Sex	Male	54 (36.7)
	Female	93 (63.3)
Education	Elementary school	5 (3.4)
	Junior high school	5 (3.4)
	Senior high school	98 (66.7)
	Higher education	39 (26.5)
Occupation	Civil servant	3 (2.0)
	Private employees	80 (54.4)
	Health workers/cadres	7 (4.8)
	Unemployed	57 (38.8)
COVID-19 vaccination status	Second dose	36 (24.5)
	Third dose (booster)	111 (75.5)

Table 2. Distribution of Social Media Access, Community Knowledge, Community Acceptance, and Adherence to Health Protocols

Variable	Category	n (%)
Social media access	No access	42 (26.8)
	Limited access	68 (46.3)
	Good access	37 (25.2)
Knowledge	Low	28 (19.0)
	High	119 (81.0)
Acceptance	Low	96 (65.3)
	High	51 (34.7)
Adherence to Health Protocols	Bad	44 (29.9)
	Good	103 (70.1)

Table 3. Distribution of Adherence to Health Protocols Based on Community Characteristics, Social Media Access, Knowledge, and Community Acceptance

Variable	Category	Adherence to Post-Vaccination Health Protocols (n, %)		OR	95% CI	p-value
		Bad	Good			
Age (years)	Teenagers (18–20)	8 (25.0)	24 (75.0)	1.367	0.560–3.336	0.491
	Adults (21–60)	36 (31.9)	77 (68.1)	0.658	0.271–1.596	0.352
	Elderly (>60)	0 (0.0)	2 (100.0)	Ref		
Sex	Male	13 (24.1)	41 (75.9)	1.577	0.739–3.366	0.237
	Female	31 (33.3)	62 (66.7)	Ref		
Education	Higher education	12 (30.8)	27 (69.2)	0.947	0.428–2.099	0.894
	Primary and secondary education	32 (29.6)	76 (70.4)	Ref		
Occupation	Employed	28 (31.1)	62 (68.9)	0.864	0.416–1.793	0.695
	Unemployed	16 (28.1)	41 (71.9)	Ref		
Social media access	Good access	5 (13.5)	56 (86.5)	3.515	1.267–9.752	0.012*
	Some access	12 (17.6)	56 (82.4)	3.177	1.473–6.852	0.003*
	No access	27 (64.3)	15 (35.7)	Ref		
Knowledge	High	31 (26.1)	88 (73.9)	2.460	1.054–5.745	0.034*
	Low	13 (46.4)	14 (53.6)	Ref		
Acceptance	High	7 (13.7)	44 (86.3)	3.942	1.607–9.669	0.002*
	Low	37 (38.5)	59 (61.5)	Ref		

Notes: * = significant p-value<0.05, OR = Odd Ratio, CI = Confidence Interval

Table 4. Relationship between Social Media Access, Knowledge, and Community Acceptance of Health Protocols

Variable	Category	aOR	95% CI	p-value
Social media access	Good access	11.983	3.601–39.873	0.000*
	Some access	8.624	3.360–22.133	0.000*
	No access	Ref		
Knowledge	High	2.699	1.084–7.402	0.044*
	Low	Ref		
Acceptance	High	4.193	1.505–11.682	0.006*
	Low	Ref		

Notes: * = significant p-value<0.05, OR = Odd Ratio, CI = Confidence Interval

86.3% who had high acceptance of policies for the prevention and control of the COVID-19 pandemic properly followed the COVID-19 health protocols. Multivariate analysis showed that people accessing COVID-19 educational posts on social media tended to be 11 times better at following health protocols (aOR=11.9; 95% CI = 3.6–39.8; p-value<0.001). Communities with high knowledge regarding the dangers of COVID-19 also tended to be two times better at following health protocols (aOR = 2.6; 95% CI = 1.0–7.4; p-value = 0.044). Also, communities with high acceptance of government policies and regulations tended to be four times better at following health protocols (aOR = 4.1; 95% CI = 1.5–11.6; p-value = 0.006).

Discussion

This study determined the factors related to following health protocols after receiving the COVID-19 vaccination booster in people aged 18 years and over in the South Denpasar Subdistrict. The factors studied included the sociodemographic characteristics of the community, access to social media, knowledge, and community acceptance.[23] This study showed that people who access COVID-19 educational posts on social media tend to be 11 times better at adhering to health protocols. People who had high knowledge regarding the dangers of COVID-19 and high acceptance of government policies and efforts to prevent and control COVID-19 were 2.6 and 4 times better at following health protocols, respectively.

These results can be explained by the integrated conceptual model used by Al-Dmour, *et al.*, which adopts the HBM theory combined with the influence of social media.[15] This model states that social media can affect knowledge and community behavior in adhering to COVID-19 prevention health protocols.[26] More specifically, the conceptual model explains the benefits of social media in COVID-19 health promotion efforts and increasing protection against pandemic diseases by disseminating information on public health interventions, increasing public knowledge, promoting healthy behavior, and increasing the amount of health information available to the public.[27]

In the HBM model, knowledge is one of the cue components to act. The community's knowledge and adherence to health protocols can appropriately protect themselves and their families from the threat of COVID-19.[28] The behavior of people who are ignorant of implementing post-vaccination health protocols is often triggered by the re-spread of COVID-19.[29] Knowledge is one of the factors that contribute to community discipline in following health protocols to slow the spread of COVID-19.[30] One aspect that influences people to follow the health protocols is widespread public acceptance of the policies and programs implemented by the government to tackle the COVID-19 pandemic.[31] This study explained that the HBM components, including perceived benefits, perceived barriers, self-efficacy, and cues to action, influence adherence to the COVID-19 health protocols. Communities who find the COVID-19 health protocols useful, feel threatened by the disease, have good self-efficacy, and have the ability to apply positive behavior through given cues are better at following the COVID-19 health protocols.[32]

During the pandemic, social media was used as the main source of COVID-19 information. In this study, most of the respondents used Facebook as their primary social media account, as most of the participants in this study were adults, and they were more likely to use this platform. These results can be used as evidence to improve the use of Facebook as a platform for health promotion efforts, especially education regarding the application of health protocols and vaccination programs.[33] During the COVID-19 pandemic, social media functioned optimally to change people's behavior, especially in adapting to new habits.[34]

Most respondents in this study were adults aged 21–60 years. This study used WHO standards by dividing age ranges into three groups: adolescents (18–20 years), adults (21–60 years), and the elderly (60+ years).[35] Most

respondents were female. These results showed that female individuals were more actively involved in sharing information on implementing the COVID-19 health protocols.

In terms of education, most respondents went to senior high school. Education is the dominant factor influencing one's knowledge.[36] People with higher education tend to be able to respond more rationally to the information they receive and think about the extent of the benefits they will get.[37] In addition, job status tends to be closely related to education.[38] More than half of the respondents in this study were employed. However, there were also quite a lot of unemployed people, most of whom were housewives. Notoatmodjo explained that the higher a person's education, the better the job that person is likely to receive.[39] The main limitation of this study was the data collection process. Data retrieval was usually carried out in the same period of the afternoon and evening, so the respondents found tended to be individuals of mature age, especially housewives. This reduced the variety in the obtained sample and made it difficult to generalize the study results to the total population.

Conclusion

In the post-COVID-19 era, it is still necessary to continue encouraging adherence to health protocols to prevent COVID-19 transmission. Adherence to health protocols after having the COVID-19 vaccination booster is related to good social media access, high knowledge of the threat of COVID-19 to health, and community acceptance. Optimal use of social media such as Facebook as a health promotion platform is suggested to encourage people to adhere to prevention protocols as directed by the health authorities.

Abbreviations

WHO: World Health Organization; COVID-19: coronavirus disease 2019; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2; HBM: Health Belief Model.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Health Research Ethics Commission of the Faculty of Medicine, Udayana University, No. 1974/UN14.2.2.VII.14/LT/2022.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The dataset and materials are available to share upon a reasonable request to the corresponding author.

Authors' Contribution

NLGA designed the studies, developed methodologies and data collection tools, conducted data analysis, and compiled manuscripts. DSL gave insight into all research steps and critically revised the manuscripts. NPW gave insight into all aspects of the research. All authors have approved the final manuscript.

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Occupational Stress among Academicians between Two Selected Universities in Malaysia and Indonesia During the COVID-19 Pandemic: A Comparative Study

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Abstract

Occupational stress has become a major concern for both employees and employers globally. Stress leads to a loss of interest among workers as well as unproductive and valueless outputs if not managed well. The education sector is one work setting dominated by stress. This comparative cross-sectional study aimed to determine the levels of depression, anxiety, and stress among academicians as well as their work-related stressors and coping strategies between a selected public university in Malaysia and a private university in Indonesia. A total of 82 academicians from universities in Malaysia and 52 from Indonesia were recruited using convenience sampling. Data was collected using a validated self-reported questionnaire via Google Forms. The prevalence of depression, anxiety, and stress among Malaysian academicians was 19.5%, 29.5%, and 12.2%, respectively. In contrast, the prevalence of depression, anxiety, and stress among Indonesian academicians was 15.7%, 33.3%, and 9.8%. Career development, research, teaching, and interpersonal relationships significantly contributed to stress at both universities (p-value<0.05). Participants from both universities reported using active coping, planning, venting, self-distraction, positive reframing, acceptance, and religion as coping strategies. In conclusion, determining depression, anxiety, and stress prevalence; major work-related stressors; and coping strategies are essential to maintaining the safety, health, and well-being of academicians, which eventually can encourage university administrations to provide support in enhancing their quality of life.

Keywords: academicians, coping, occupational, stress, work-related

Introduction

Stress poses a serious risk factor to the worker's physical and mental condition, as well as an organization's well-being.[1] Approximately 12.5 million working days were lost in the United Kingdom in 2016 and 2017 due to stress, depression, or anxiety.[2] The 2015 National Health Morbidity Survey (NHMS) findings reported that the prevalence of adult mental illnesses in Malaysia had risen two-fold over the past two decades to 29.2%.[3] Furthermore, in 2019, the NHMS found that about half a million people had experienced depression.[4] Depression is the most common mental condition affecting adults, and it frequently coexists with anxiety and stress.

Most public academics see their work as stressful or extremely stressful.[5] In Malaysia, public academics also face a high-stress level due to changes in the tertiary education sector. For example, five research universities in Malaysia compete for a better rank internationally to be the country's top universities. This condition indirectly pushes academic staff to speed up their performance to reach this goal.[6] Academics in these fields are expected to keep up with the pace of change and significantly contribute knowledge to solving human problems. In Malaysia, several studies have identified the prevalence of stress as 22.1% among academicians at public universities and 40% at private universities.[6-7] Although another study involving 609 academicians from four public universities in Malaysia reported low-stress scores, these results showed that stress is significant among academicians.[8]

In Indonesia, higher education is dominated by private institutions. Due to a lack of space in public institutions, private universities nationwide serve more than 4.5 million students enrolled in higher education.[9] The increase in the number of students enrolled in university may lead to increased workloads for academic staff. In addition to those activities, the government also demands that academicians be involved in high-pressure work activities.[10]

The data collection period for this study took place

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during the initial stage of the COVID-19 pandemic from February 2020 until June 2020, when the Movement Control Order (MCO) had just started. The Malaysian Government and its Ministry of Health (MOH) implemented the MCO on 18 March 2020 to manage disease spread and minimize COVID-19 mortalities. The Indonesian Government implemented a similar decree on 16 March 2020. Public institutions, including higher education institutions and schools, were urged to close due to COVID-19 to allow students to implement social distancing policies.[11] However, the rapid adaptation period to the new norm, which necessitated teaching online, seemed impossible to switch seamlessly overnight, which could have influenced mental health.

A study conducted among teachers during the COVID-19 pandemic found that the percentages of respondents with mild, moderate, severe, and very severe stress accounted for 12.8%, 12%, 5.3%, and 2.5%, respectively.[12] Furthermore, a study conducted among 70 medical university academicians reported a higher prevalence of depression (32.9%), anxiety (42.8%), and stress (40.0%) during COVID-19.[7] Another study conducted among academicians during the work-from-home period of the COVID-19 pandemic reported that a lecturer's stress level is positively correlated with time management, distractions, social isolation, focus, and technology.[13] Thus, it is important to determine the depression, anxiety, and stress level among Malaysian and Indonesian academicians as well as identify the work-related factors and coping strategies to improve their safety, health, and well-being.

Method

This study was a comparative cross-sectional study design, utilizing a convenience sampling method. Study participants were recruited among the academicians at two selected universities on the east coast of Malaysia and Jakarta, Indonesia, respectively. The target population at both universities was selected within the following inclusion and exclusion criteria: (i) academicians who were working for more than 6 months; (ii) aged 18 years and above; (iii) excluding those who were on sabbatical, maternity, study, sick leave, and on leave for more than three months (throughout the study).

This study used an adapted questionnaire piloted among lecturers at Universiti Malaysia Terengganu, Malaysia.[14] The questions were asked in English among Malaysian academicians. However, the questionnaire was back-to-back translated into Indonesian and underwent face validity to ensure suitability and comprehensibility among Indonesian academicians. The pre-tested and self-administered questionnaires consisted of 64 questions divided into four sections. Section A consisted of sociodemographic factors, and Section B consisted of work-related factors. In this section, the Stress Sources Questionnaire (SSQ) developed by Archibong and colleagues was utilized,[16] and permission has been obtained from the authors.

The SSQ was used to assess the extent of stress in four work-related domains: interpersonal relationships, career development, research, and teaching. Each domain contained five items. The items were measured on a 4-point Likert scale ranging from "extremely stressful" to "not stressful".[15] Section C examined the psychosocial characteristics of the respondents, which consisted of twenty-one questions on depression, anxiety, and stress (DASS). The items were measured on a 4-point Likert scale ranging from "almost always" to "never".[16] Section D assessed the coping skills of respondents. The questions in this section were adapted from the Brief Coping Orientation to Problems Experienced (COPE) questionnaire.[17]

Data was collected after ethical approval was obtained. A list of academicians' names, emails, and departments was obtained from the Administrative Department, Registrar, and Dean's office of both universities. All academic staff were invited via email to participate in the study and were given a week to consider. Then, an invitation letter, a set of questionnaires, a consent form, an information sheet created via Google Forms, and a copy of the permission letter to conduct this study were sent through email and WhatsApp. The questionnaires were able to be completed within 10 minutes. Google Forms was chosen as a platform due to the enforcement of the MCO and the distance learning implementation during the coronavirus disease 2019 (COVID-19) pandemic.

Statistical analysis was conducted using software for advanced statistical analysis. Descriptive statistics were used to illustrate the demographic profile of the academicians and coping strategies. A Mann–Whitney test was used to compare the stress scores between the academicians in both universities. Spearman's Correlation test was used to correlate the stress score and score of work-related factors among the academicians.

Results

Table 1 shows the sociodemographic data of respondents from Malaysia and Indonesia universities. Out of 82 respondents at a university in Malaysia, the majority were female (58.5%), married (91.5%), and had master's degrees (54.9%) as their highest education level, followed by a Ph.D. (39%). The respondents were mostly lecturers or senior lecturers (58.5%), and 42.7% held management posts at a university in Malaysia.

Similarly, out of the 51 respondents at a university in Indonesia, the majority were females (62.7%), married (86.3%), and had a master's degree (88.2%) as their highest education level, while 11.8% had a doctoral de-

Table 1. Academicians' Sociodemographic Information

Variable	Category	Frequency (%)	
		Malaysia (n = 82)	Indonesia (n = 51)
Sex	Male	34 (41.5)	19 (37.3)
	Female	48 (58.5)	32 (62.7)
Age (years)	20-29	2 (2.4)	3 (5.9)
	30-39	24 (29.3)	14 (27.5)
	40-49	42 (51.2)	18 (35.3)
	50-59	14 (17.1)	12 (23.5)
	60-69	-	3 (5.9)
	70-79	-	1 (2.0)
Ethnic group	Malay	79 (96.3)	-
	Indian	1 (1.2)	-
	Sundanese	-	14 (27.5)
	Bataknese	-	1 (2.0)
	Javanese	-	21 (41.2)
	Makassar	-	1 (2.0)
	Others	2 (2.4)	-
Highest education	Bachelor	5 (6.1)	-
	Master's	45 (54.9)	45 (88.2)
	Doctoral	32 (39.0)	14 (27.5)
Marital status	Single	7 (8.5)	4 (7.8)
	Married	75 (91.5)	44 (86.3)
	Widowed	-	1 (2.0)
	Divorced	-	2 (3.9)
Working period (years)	1-9	34 (41.5)	28 (54.9)
	10-19	38 (46.3)	12 (23.5)
	20-29	9 (11.0)	11 (21.6)
	30-39	1 (1.2)	-
Position	Temporary/Contract staff	6 (7.3)	
	Permanent staff	76 (92.7)	
	Home-based lecturer	-	18 (35.3)
	Staff	-	10 (19.6)
	Lecturer with structural department	-	23 (45.1)
Designation	Lecturer	11 (13.4)	-
	Lecturer/Senior Lecturer	48 (58.5)	-
	Associate Professor	18 (22.0)	16 (31.4)
	Professor	5 (6.1)	35 (68.6)
	Hold administration post		
	No	47 (57.3)	22 (43.1)
	Yes	35 (42.7)	29 (56.9)
Monthly household income	RM 4,001–6,000	2 (2.4)	-
	RM 6,001–8,000	10 (12.2)	-
	RM 8,001–10,000	12 (14.6)	-
	RM 10,001–13,000	16 (19.5)	-
	>RM 13,000	44 (51.2)	-
	<IDR 3,5 million	-	11 (21.6)
	IDR 3,6–5 million	-	20 (39.2)
	IDR 5,1–8 million	-	10 (19.6)
	IDR 8,1–10 million	-	3 (5.9)
	IDR 10,1–15 million	-	4 (7.8)
	>IDR 15 million	-	3 (5.9)

gree Regarding positions, more than half of the respondents were lecturers or senior lecturers (68.6%). Additionally, only 29 (56.9%) respondents held management posts at a university in Indonesia

The prevalence of depression, anxiety, and stress was higher among Malaysian academicians than among Indonesian. Among the Malaysian academicians, the highest prevalence was anxiety (29.3%), followed by depression at 19.5% and stress at 12.2%. A similar trend was reported among the Indonesian academicians: the prevalence of anxiety was highest (33.3%), followed by depression (15.7%), then stress (9.8%).

Table 2 shows the median differences in depression, anxiety, and stress scores between university in Malaysia and Indonesia. The depression score was significantly higher among Malaysian academicians (median score of 4, IQR = 2-8) compared to Indonesian (median score of 2, IQR = 0–6), p-value = 0.046.

Table 3 shows the correlation between stress scores and the score of work-related factors at both universities. In Malaysia, the findings showed that all work-related factors had a significant linear relationship with stress (p-value<0.05) except for career development (r = 0.185, p-value = 0.096). In Indonesia, all work-related factors had a significant linear relationship with stress (p-value<0.05). As the previous section's findings showed no significant difference in stress scores between both universities academicians, the descending correlation trends for both populations were interpersonal relationship > teaching > research > career development.

Table 4 shows the coping strategies among respondents. This study found that the most used coping strategies at both universities were active coping, planning, venting, positive reframing, acceptance, and religion. However, humor was used only among Indonesian academicians as a medium to combat stress.

Table 2. Median Different of Depression, Anxiety, and Stress Scores between Malaysian and Indonesian Academicians

Variable	Median (IQR)		Z statistic	p-value[a]
	Malaysia	Indonesia		
Depression score	4 (2-8)	2 (0-6)	-1.999	0.046*
Anxiety score	4 (2-8)	4 (0-8)	-0.227	0.820
Stress score	10 (4-14)	8 (4-14)	-0.112	0.911

Notes: Statistical test – Mann-Whitney test, *significant difference at p-value<0.05

Discussion

Malaysian academicians had multiple roles besides being educators, including supervisors, researchers, and administrative workers, while simultaneously carrying out non-academic matters regarding their families and personal lives. Similarly, the Indonesian legislation concerning higher education, teachers, lecturers, and the national education system has clearly stated the roles and responsibilities of academicians at universities in Indonesia.[18-20] That no significant differences were found in this study for both anxiety and stress scores between academicians of both universities may be due to the similarities in working relationships, job demands, organizational factors, and individual coping strategies.

Table 3. Correlation between Stress Score and Score of Work-Related Factors

Variable		Stress Score		
		Malaysia (n = 82)	Indonesia (n = 51)	Total (n = 133)
Career development	r	0.185	0.413	0.259
	p-value	0.096	0.003*	0.003*
Research	r	0.283	0.424	0.320
	p-value	0.010*	0.002*	0.001*
Teaching	r	0.418	0.515	0.451
	p-value	0.001*	0.001*	0.001*
Interpersonal relationship	r	0.373	0.596	0.456
	p-value	0.001*	0.001*	0.001*

Notes: *Statistical test- Spearman's Correlation test, *Significant difference at p-value<0.05

Table 4. Coping Strategies among Academicians

Coping Strategy	Category	Frequency (%)	
		Malaysia	Indonesia
Problem focused	Active coping	77 (93.9)	49 (96.1)
	Use of instrumental support	58 (70.7)	46 (90.2)
	Planning	78 (95.1)	49 (96.1)
Dysfunctional coping strategy	Self-distraction	74 (90.2)	49 (96.1)
	Denial	40 (48.8)	23 (45.1)
	Substance use	-	3 (5.9)
	Behavioral disengagement	36 (43.9)	18 (35.3)
	Venting	67 (81.7)	43 (84.3)
	Self-blame	54 (65.9)	49 (96.1)
Emotion-focused	Emotional support	53 (64.6)	45 (88.2)
	Positive reframing	79 (96.3)	50 (98.0)
	Acceptance	78 (95.1)	49 (96.1)
	Humor	47 (57.3)	42 (82.4)
	Religion	77 (93.9)	50 (98.0)

Moreover, academicians at public or private institutions may experience similar anxiety in the workplace that may be influenced by the fear or dread of the higher management, colleagues, or an inconducive working environment. It is well known that work-related stress is a major cause of occupational ill health, poor productivity, and human error.[21]

The academicians at both universities in this study experienced stress arising from career development, followed by research, teaching, and interpersonal relationships. Regarding career development, the academicians would work under increasing pressure to meet the expectation to publish high-quality research in reputable journals to be promoted.[22-23] However, even though they publish many papers, they might not yet be promoted due to the complexity of the promotion process. Another major stress component in career development was encountering obstacles in sourcing funds to further studies to the highest qualification (doctoral degree), which may result in delayed career development. Hence, the government needs to allocate adequate funds for academicians to further their studies and expand their profession to a higher position.

The second most stressful source of stress at both universities in this study was the research aspect, with a significant correlation, p-value<0.05. In order to produce good-quality publications, academicians need to secure research grants. Moreover, the cost to obtain up-to-date materials, support daily operations, and purchase appropriate equipment for the research study are very high. Such situations are applicable to a research university and to academicians in private universities who are encouraged not only to teach, but also to produce research outputs per the university management structure. Furthermore, during the COVID-19 pandemic, academicians working from home could not perform laboratory work due to the MCO.

Similarly, for both universities, a significant correlation was observed between teaching and stress scores pertaining to course content development. The academicians did not have enough time to develop the subject module before teaching.[24] Moreover, due to the COVID-19 pandemic, traditional face-to-face teaching and learning switched to online learning, and academicians were required to work from home. The global crisis undoubtedly impacted their educator duties, as they faced the challenge of ensuring that no student fell behind while addressing their own personal duties, family matters, and dread surrounding COVID-19.[13]

The most stressful indices arising from interpersonal relationships were students, non-teaching staff, and colleagues. An increased number of students leads to an increased workload for educators. Previous studies claim that unfavorable student-to-lecturer ratios, student-related issues, and interpersonal matters have significantly contributed to stress among academic staff.[23,25] Poor interpersonal relationships with non-teaching staff, such as the administrative and laboratory staff may also be a major occupational stressor for academic staff. This may be attributed to poor social support that creates interpersonal conflict and affects academicians' performance, as seen in delays in work completion and poor mental health. However, a previous study claims that interpersonal relationships with non-teaching staff were the least stressful and considered normal in human relations.[15]

This study found that the most used coping strategies at both universities were active coping, planning, venting, positive reframing, acceptance, and religion. This finding was supported by previous studies claiming that the most important stress-coping strategy was positive reinterpretation and growth, turning to religion, planning, active coping, acceptance, and venting emotions.[26-30] Active coping and planning are known as problem-focused coping strategies as they find alternative ways to eliminate the stressful situation. The relaxation technique coping strategies such as prayer, recreational activities, and exercise were employed to reduce stress.[31] These activities give a sense of detachment from daily pressures and enhance the performance of academicians in their careers. These coping strategies align with academicians' cultural approaches and ethical beliefs in increasing their mental resilience.

According to the Indonesian Law No. 14 of 2003, the Indonesian legislation shall protect the safety and health of teachers and lecturers.[20] Similarly, the object of the Malaysian Occupational Safety and Health Act (1994) is to secure the safety, health, and welfare of persons at work, whereby the term health refers to a state of complete physical, mental, and social well-being.[32] Although there are no specific guidelines on mental health in the workplace, the awareness of such public health issues is increasing, especially post-COVID-19. Malaysia's MOH published a Community Mental Health Centre MENTARI MOH Implementation Guideline in 2020 following the Mental Health Act [Act 615] and Regulation.[33] Universities may collaborate with Mentari to create partnerships in promoting mental service provision and community empowerment.

Conclusion

This study shows that the most work-related stressor experienced by academicians at both universities is career development, followed by research, teaching, and interpersonal relationships. The findings of this study help academicians be more aware of the sources of stress to manage stress and prevent mental health problems. This information is essential for policy decision-makers, future researchers, and authorities to take the initiative in main-

taining academicians' safety, health, and welfare. These findings should also encourage university management to provide support to enhance academicians' quality of life by developing stress management seminars, cultivating a supportive work environment, and providing more research funding.

Abbreviations

NHMS: National Health Morbidity Survey; MCO: Movement Control Order; MOH: Ministry of Health; SSQ: Stress Sources Questionnaires; COVID-19: coronavirus disease 2019.

Ethics Approval and Consent to Participate

This study was approved by the Human Research Ethics Committee (JEPeM) of Universiti Sains Malaysia (reference code: USM/JEPeM/19110728). Prior to data collection, consent was obtained to ensure voluntary involvement, and the confidentiality/anonymity of the respondents in this study was secured.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The dataset and materials are available to share upon a reasonable request to the corresponding author.

Authors' Contribution

SMA and ATE conceptualized, designed, interpreted the data, and approved the final draft. NHR prepared the initial draft, collected, and analyzed the data. WSH collected the data. NM and TAEI approved the final draft.

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Utilizing Rapid Molecular Tests (RMT/RIF) in Tuberculosis Drug-Sensitive/Resistant Discovery in Indonesia: A Pilot Study

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Abstract

The underdiagnosis and underreporting of tuberculosis (TB) indicators are unresolved problems. The rapid molecular test (RMT) is one of the breakthroughs for TB case finding by using safer and more sensitive equipment; it is even believed to help find drug-resistant TB. The results of several webinars held regularly by a TB program as well as its evaluation and the use of RMT, formed the basis of this study. This initial pilot study aimed to provide an overview of case finding for both drug-sensitive and drug-resistant TB using RMT. A cross-sectional study was conducted on samples in several provinces in Indonesia that have used RMT, both in remote or non-remote island borders areas and fiscal capacity. Regarding the use of RMT for drug-sensitive TB case finding, the largest contributors were males aged above 15 years, while in the drug-resistant TB case finding group, the biggest contributor was the use of RMT in 2017 and 2018. Overall, the findings could only describe the situation in the study area. The use of RMT in drug-sensitive TB case finding would be maximized if the detected cases are males aged above 15 years, while RMT can help find cases of drug-resistant TB.

Keywords: case finding, Indonesia, rapid diagnosis, tuberculosis

Introduction

Indonesia is "The 3rd largest contributor to tuberculosis (TB) prevalence cases in the world after South Africa and Cambodia."[1] The burden of TB disease in Indonesia is relatively high. The prevalence of TB in Indonesia has fluctuated; from 393/100,000 in 2007, 725/100,000 in 2010, 289/100,000 in 2011, 400/100,000 in 2013, and 647/100,000 in 2015, and the TB death rate went from 92/100,000 in 1990 to 27/100,000 in 2011.[2-5] According to the 2014 TB prevalence survey, the number of confirmed bacterial TB cases was 759/100,000, with a positive smear rate of 257/100,000.[6]

Examining the range of case numbers, one can observe that the results of TB control in Indonesia are still in place. Given the limited situation and conditions, TB prevalence data comes from multiple sources, and various measurement methods are performed. The prevalence of TB in Indonesia is still high in terms of culture examination.

World Health Organization (WHO)'s global plan for treating TB cases began with the directly observed treatment short-course (DOTS) Strategy, introduced in 1990.[7] Other strategies include political commitment, case detection by microscopic examination for patients with chronic cough, treatment using standard and brief chemotherapy with direct observation, TB case management, and a good recording and reporting system.[7]

Boehme, *et al.,* found that X-pert MTB/RIF examination could detect 90.3% of TB culture-confirmed cases compared to 67.1% by microscopic examination.[8] X-pert MTB/RIF has a sensitivity and specificity of 76.9% and 99.0%, respectively, for smear-negative positive cultures as well as a sensitivity of 94.4% and a specificity of 98.3% for the rifampin-resistant test.[8] A study in Tanzania on the accuracy of Gen X-pert MTB findings found a sensitivity and specificity of 88.4% and 99%, respectively.[9] In Uganda, analyzing sputum from children aged two months to 12 years for the X-pert MTB/RIF test exhibited a sensitivity of 79.4% and a specificity of 96.5%.[10]

Because MTB/RIF can detect all specimens, the WHO set several policy recommendations for using gen X-pert MTB/RIF.[11] Among others: X-pert MTB/RIF is used as an initial diagnostic test in adults and children suspected of suffering from MDR-TB or HIV-associated TB as a

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strong recommendation, and X-pert MTB/RIF can be used as the initial diagnostic test in all adults and children suspected of having TB as a conditional recommendation rather than conventional microscopy and culture. The Indonesian Minister of Health Regulation No. 67 of 2016 states that one of the ways to diagnose TB cases is by examining gen X-pert MTB/RIF.[11]

In 2014–2015, X-pert machines were distributed in 59 cities and districts in Indonesia. Then at the end of December 2016, X-pert MTB/RIF machines were distributed and installed in 142 health facilities in Indonesia. Until the end of 2017, X-pert MTB/RIF machines were distributed to 600 health facilities.[12] Along with the distribution of the MTB/RIF tool, TB cases in several health facilities have increased. In 2016, the number of TB cases was 360,565; this increased to 568,987 in 2019 but was still far from the estimated incidence.[13] Thus, this initial pilot study aimed to provide an overview of the use of RTM and RIF in the case finding of rifampicin-sensitive and rifampicin-resistant TB, considering the abovementioned problem. This study would be evidence for introducing one of the breakthroughs for TB case finding by using safer and more sensitive equipment.

Method

This sub-national representative study was carried out cross-sectionally by looking at the use of RTM/RIF from 2014 until 2018. The total sample was 43 health facilities, consisting of 41 hospitals and 2 primary health care using RTM/RIF in 42 districts in Indonesia. TB case report data was taken for further processing. The RTM/RIF results shown were rifampicin-sensitive TB and rifampicin-resistant TB.[14] The regional status variables consist of high fiscal lagging regions, moderate fiscal lagging regions, low fiscal lagging regions, high fiscal non-lagging regions, moderate fiscal non-lagging regions, low fiscal non-lagging regions, sex, age group (<15 years), and year of use of RTM/RIF (from 2014 until 2018). The data analyses were univariate and multivariate and were conducted using software for advanced statistical analysis.

Results

The distribution of MTB/RIF results showed five categories: negative, rifampin sensitive, rifampicin-resistant, intermediate, and failed. Table 1 shows that after examination with the RMT, the mean rifampicin-sensitive cases were 0.27, while the mean rifampicin-resistant cases were 0.03. While, in the distribution of years of use of RTM/RIF, there was an increase in the use of MTB/RIF in the detection of suspected TB cases. The use of RTM/RIF was still dominant in determining cases in the age group of 15 years and older, and the male group had a higher proportion of suspected TB cases than the female group.

Table 2 shows the status of the sample areas using RTM/RIF. The sample areas were not evenly distributed in the medium to minimum capacity areas. The most sampled areas were both in remote or non-remote island borders areas. The relationship between case finding and regional status was not statistically significant.

The final results of the linear regression produced two outputs: the results of RTM/RIF-sensitive and resistant rifampicin. The R square values were around 0.44 and 0.32, showing a weaker relationship, although a significant relationship was detected, 0.00 and 0.02, with R (0.66 and 0.57). Also, it contributed the most to the case findings, with both drug-sensitive and drug-resistant rifampicin. In contrast, the age group of less than 15 years old barely contributed to the TB case findings, as did the female sex group.

The use of RTM/RIF in the case finding of rifampicin-sensitive TB was the most effective in the male group, followed by the age group of over 15 years old, while the

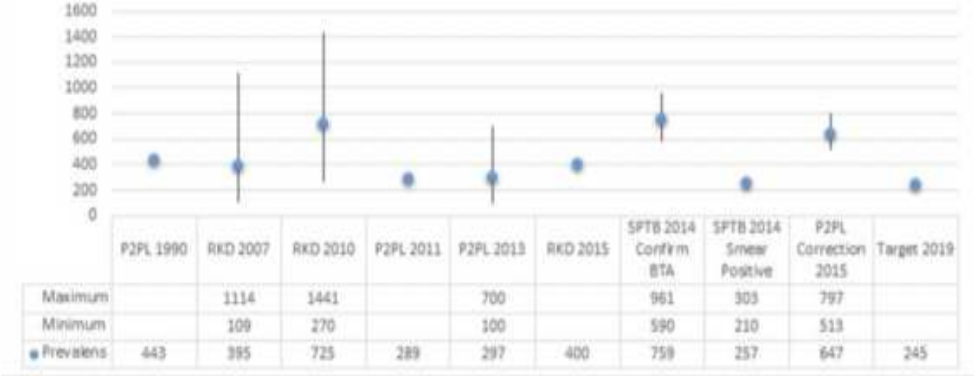

Figure 1. Prevalence of Tuberculosis in 1990–2015 and Projected Prevalence in 2019

Table 1. Distribution of Rapid Molecular Test Results of Suspected TB Cases in 43 Health Facilities in 2018 in Indonesia

Variable	Category	n	Mean	SD	Min–Max
RTM/RIF result	Negative	43	0.69	0.07	0.5–0.8
	Rifampicin-sensitive	43	0.27	0.06	0.18–0.45
	Rifampicin-resistant	43	0.03	0.02	0–0.09
	Intermediate	43	0.00	0.00	0–0.01
	Failed	43	0.01	0.01	0–0.05
Year	2014	43	0.00	0.01	0–0.03
	2015	43	0.01	0.02	0–0.08
	2016	43	0.04	0.07	0–0.30
	2017	43	0.35	0.14	0–0.56
	2018	43	0.60	0.18	0.3–1
Age	<15 years	43	0.03	0.03	0–0.16
	≥15 years	43	0.97	0.03	0.84–1
Sex	Male	43	0.60	0.05	0.48–0.73
	Female	43	0.40	0.05	0.27–0.52

Table 2. Relationship between Rapid Molecular Test Results (Sensitive and Resistance of Rifampicin) Case Findings with Regional Status

	Area	n	%	Mean	SD	95% CI	Sig.
Rifampicin-sensitive	Non-remote island borders areas-high fiscal	7	16.3	0.29	0.06	0.23–0.34	0.25
	Non-remote island borders areas-under intermediate fiscal	17	39.5	0.28	0.07	0.24–0.32	
	Remote island borders areas-high fiscal	3	7.0	0.32	0.08	0.12–0.51	
	Remote island borders areas-under intermediate fiscal	16	37.2	0.25	0.05	0.22–0.28	
Rifampicin-resistance	Non-remote island borders areas-high fiscal	7	16.3	0.04	0.03	0.01–0.07	0.23
	Non-remote island borders areas-under intermediate fiscal	17	39.5	0.03	0.02	0.02–0.04	
	Remote island borders areas-high fiscal	3	7.0	0.02	0.01	0.01–0.03	
	Remote island borders areas-under intermediate fiscal	16	37.2	0.02	0.02	0.01–0.03	

Notes: SD = Standard Deviation, CI = Confidence Interval

Table 3. Final Linear Regression of Rapid Molecular Test Results (Sensitive and Resistance of Rifampicin) Case Findings

Variable		B	SE	β	T	Sig.	95% CI
Rif-sensitive (constant)		-0.63	0.27		-2.35	0.02	-1.17– -0.09
	Male	0.59	0.15	0.49	3.83	0.00	0.28–0.90
	≥15 years old	0.56	0.28	0.26	2.00	0.05	-0.01–1.13
Rif-resistance (constant)		0.13	0.03		3.86	0.00	0.06–0.20
	2017	-0.10	0.04	-0.69	-2.41	0.02	-0.19– -0.02
	2018	-0.12	0.03	-1.00	-3.48	0.00	-0.18– -0.05

Notes: SD = Standard Deviation, CI = Confidence Interval

use of RTM/RIF for the case finding of rifampicin-resistant TB contributed the most to the results. A negative relationship was detected between the use of sensitive and rifampicin-resistant in 2018 and 2017.

According to Dougherty, a negative constant or intercept in Table 3 can be interpreted as 0, meaning that if the examination of a man suspected of having TB is 0, then rifampicin is sensitive (–0.63).[14] It can also be reversed, Y = 0.59 (X) – 0.63, meaning that if the RTM/RIF tool is used to detect TB in the male group, for example, the equation Y = 0.59(2) – 0.63 = 0.55 means that the rifampicin TB case finding is 55% sensitive.

Discussion

Using RTM/RIF in detecting suspected TB cases will help detect TB sensitivity and resistance to rifampicin. To treat TB resistance to other drugs, referrals must be made for culture propagation in hospitals with adequate equipment and human resources. The results of the R-squared analysis on the use of RTM/RIF for sensitive and resistant rifampin were 37% and 30%, while the remaining 63% and 70% can be explained by other vari-

ables.[15,16]

The group of male TB suspects detected using RTM/RIF had a high (59%) contribution to the case finding of rifampicin-sensitive TB. Meanwhile, the 15-year-old group contributed 56% to the case finding of rifampicin-sensitive TB. These results were consistent with several descriptions of TB cases in Indonesia reported in the Tuberculosis Prevalence Survey, TB inventories, and several TB studies conducted in Indonesia.[3-6,17]

The age group above 15 suspected of TB has a major contribution to the case finding of rifampicin-sensitive TB. These results also matched some findings in Indonesia, although this should be observed carefully because Indonesia's TB program prioritizes those over 15 years. Another problem with diagnosing TB in children is the limited number of human resources and equipment in all health facilities in Indonesia.

The use of devices in 2017 and 2018 significantly increased TB resistance to rifampicin. It shows an increase in the use of RMT from 0% to 60%, but it also shows a decrease in finding cases of resistance to rifampicin in 2017 and 2018. These results may be because many suspected TB cases were examined by RMT but not recorded. Several factors, including the possibility of changing or moving officers, may affect the health facilities in several study sample areas.[18-20]

Conclusion

This initial pilot study shows that in the distribution of years of use of RTM/RIF, there is an increase in the use of MTB/RIF in the detection of suspected TB cases. However, at the same time, there is a decrease in finding cases of resistance to rifampicin. Although the RMT will potentially facilitate and expedite the discovery, recording, reporting, and treatment of TB cases with rifampicin resistance and sensitivity to suppress such cases, further research is still needed. Some health facilities that use RMT must still be supported by the presence of reagents, the infrastructure, and the availability of TB drugs considering that RMT facilitates TB case finding.

Abbreviations

RMT: Rapid Molecular Test; TB: Tuberculosis; WHO: World Health Organization; DOTS: Directly Observed Treatment Short-Course.

Ethics Approval and Consent to Participate

The study was conducted following the Declaration of Helsinki, and approved by the Ethic Commission for Health Research, Indonesian Ministry of Health No. 880/KRKI/V/2018. Inform license obtained from institution and research subject.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and information used as study materials can be obtained publicly from the Center for Data Management, Indonesian Ministry of Health.

Authors' Contribution

MHH is the main contributor, responsible for the ideas created, analysis, and preparation of writings. MV and MHH performed formal analysis, investigation, interpretation, and writing-original draft preparation. MHH supervised the study and writing review and editing. D, DBL, MW, BR, RYP, R, FA, and HS were subsequently involved in conceptualization, methodology, software, validation, resources, data curation, writing review, and editing. All authors have made substantial contributions to the final manuscript for publication.

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Volume 18, Special Issue 1, July 2023

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Author Index

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Volume 18, Special Issue 1, July 2023

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