ORIGINAL ARTICLE

The effect of telemedicine plus application on the covid-19 patients' quality of life

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ABSTRACT

The covid-19 pandemic affects human life quality. The consultations between patients and health workers are carried out online using telemedicine to stop transmission. This research aimed to assign the effect of the Telemedicine Plus application on the Covid-19 patients' quality of life. The study method was quasi-experimental with the pretest-posttest nonequivalent control group design. The participants were 60 patients who were confirmed positive for Covid-19 in the Ngoresan Region, Surakarta City. The sampling technique used was purposive sampling. There were two types of subject criteria: the intervention group, given the Telemedicine Plus application and the control group, given standard therapy. The life quality of the Covid-19 patients was rated using the Short-Form 36 (SF 36) questionnaire. Participants who applied the Telemedicine Plus application experienced an increase in average life quality scores from 39.70 to 50.93, while respondents who received a standard therapy also experienced an increase from 39.93 to 41.67. The independent t-test indicated <0.001 (<0.05) for a p-value. It points out that there is a difference in life quality between the intervention group and the control group significantly. The Telemedicine Plus application improves the Covid-19 patients' life quality more than patients who receive standard therapy.

Key words:
Telemedicine; application; covid-19; life quality

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INTRODUCTION

Coronavirus Disease-19, abbreviated as Covid-19, is categorized as a pandemic or global outbreak that has spread to 213 countries, with the first case report at the end of 2019 in China.[1] Data from Kementerian Kesehatan Republic of Indonesia as of February 23rd, 2022, reported 5,289,414 positive cases of Covid-19 with 4,593,185 (85%) deaths and 549,431 active cases (10.4%).[2] This disease has symptoms of shivers, headache, cough, sore throat, and exhaustion. [3]

Covid-19 affects the life quality for both sufferers and the general public. Life quality is a phenomenon on a large scale based on physical and psychological conditions, level of independence, and a person's relationship with the environment.[4,5] Factors that affect life quality are physical health, psychological health, power, support system, skills, life events, political and environmental changes, sociodemographic character, stress and coping abilities, and social support.[6]

Long periods of isolation can disrupt physical and psychological health and cause fear of pain, irritability, insomnia, and uncontrollable anger due to extreme psychological and mood disturbances during the Covid-19 exposure. Problems of mental health occur more significantly in Covid-19 sufferers than in healthy people.[5,7] Quality of life also shows a horizontal connection between the severe condition of symptoms and the pact on the patient's physical, mental and emotional health.[5]

The Ministry of Health recommends decreasing exposure to Covid-19 by washing hands with soap and running water, wearing masks, staying away from crowds, maintaining distance, and limiting interaction and mobility.[8] Health promotion efforts are also being promoted as an attempt to decrease covid-19 transmission. The rapid spread of disease requires appropriate and effective strategies and solutions to continue providing health services without physical or face-to-face contact. Socialization and consultation between patients and doctors are carried out online so the goal of improving life quality and public health in breaking Covid-19 exposure can be achieved. At this time, the type of health promotion to increase general knowledge about the transmission, prevention, and control of Covid-19 is through the application system.[9]

Telemedicine is one of the health sector developments in the digital field. Telemedicine is a system for conducting medical therapy that is not obstructed by space.[10] Telemedicine makes it easy for patients to discuss with doctors without face-to-face meetings. It is hoped that the discussion results can assist patients in receiving information regarding the suspected diagnosis, treatment for the disease, and information on improving health, body fitness, and community sanity during the Covid-19 global outbreak. The Telemedicine Plus application has five main features: general assessment, daily assessment, consultation with doctors about the patient's condition, consultation related to nutrition, vaccination schedule, and information about Corona Virus Disease-19.

This research aimed to determine the effect of the Telemedicine Plus application on the life quality of Covid-19 sufferers.

METHODS

Ethics approval

This research has received ethical approval with ID No. 63/II/2022/Komisi Bioetik. Respondents are voluntary and have the right to resign without further explanation. All prospective respondents in

this study were given comprehensive information regarding the research implementation process and all participants signed the informed consent. All information collected is confidential and is not disclosed to anyone other than the researcher. No name appears on the results, and the coding system is known only to the researcher.

Study design

The research used quantitative methods; a quasi-experimental design with a pretest-posttest nonequivalent control group. The participants were all patients who were confirmed positive for Covid-19 in the Ngoresan Region, Surakarta City, Indonesia, undergoing independent isolation. Sampling was carried out by purposive sampling by considering exclusion and inclusion criteria. The inclusion criteria are people who test positive for Covid-19, have mild symptoms, have/do not have comorbidities, have a low, medium, or high economic status, have a smartphone or laptop, and can use a smartphone or laptop independently. The exclusion criteria were people who tested positive for Covid-19 with moderate to severe symptoms or had to be transferred to the hospital. The study subjects obtained were 60 patients from March-June 2022. Participants were divided into two groups. The study group was divided using randomization based on patients' arrival. The total number of participants for the intervention and control groups was 30 for each group.

The use of the Telemedicine Plus application was the independent variable, while the dependent variable in this research was the Covid-19 patients' life quality. The life quality of Covid-19 patients was measured by the Short-Form 36 (SF 36) questionnaire. The SF 36 questionnaire is one of the instruments used to assess life quality. This research used the Indonesian version of the SF 36 questionnaire, which has changed the validation structure. The validity tests are the convergent and known groups validity tests. The Cronbach's alpha used for the reliability test of the questionnaire pointed to a value of 0.70. The convergent validity test showed that the value of each domain was 0.4, while the known groups validity test showed a p-value of 0.05. The SF 36 questionnaire consists of 36 questions. The Short Form-36 is a survey questionnaire that measures eight health criteria: physical function, role limitations due to physical health, body pain, the general perception of health, vitality, social functioning, role limitations due to emotional problems, and psychological health. This measure produces scale scores for each of the eight health criteria and two summary measures of physical and psychological health. The total scores from 36 questions result from the SF 36 questionnaire. The better life quality was equal to the higher questionnaire score. The life quality assessment was performed on the first day the patient started self-isolation and when the patient had a negative PCR test result and completed self-isolation.

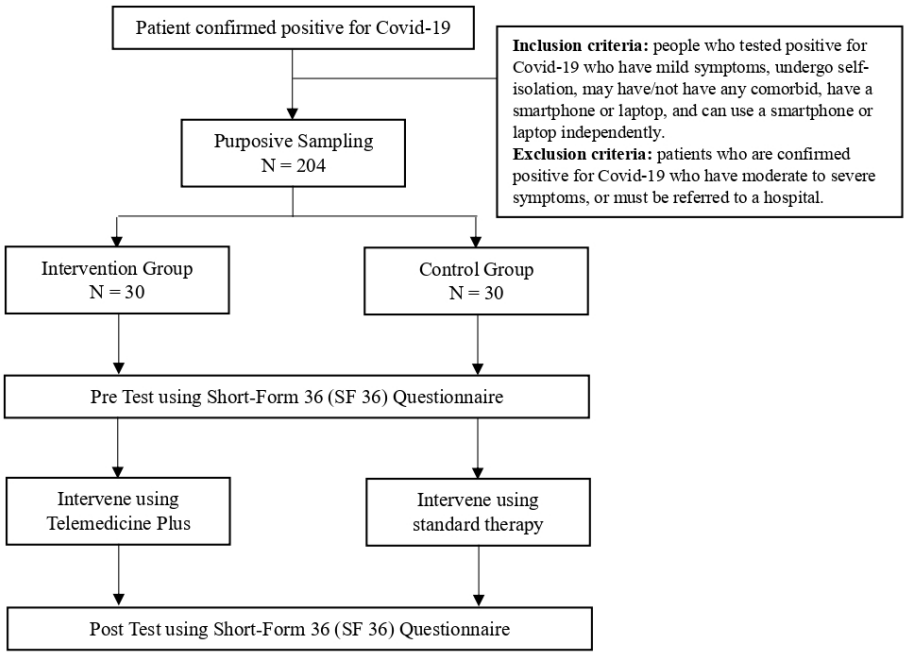

Chart 1. Research Flow

The patient carries out a general assessment at the public healthcare centre; when the patient is confirmed positive for Covid-19, further examination will be conducted to determine whether the infection falls into the mild, moderate, or severe category. If the patient is confirmed to be in the mild category, then the appropriate drug is given. Then, the patient can undergo self-isolation accompanied by the Telemedicine Plus application for remote medical consultation. The following is an overview of telemedicine Plus features:

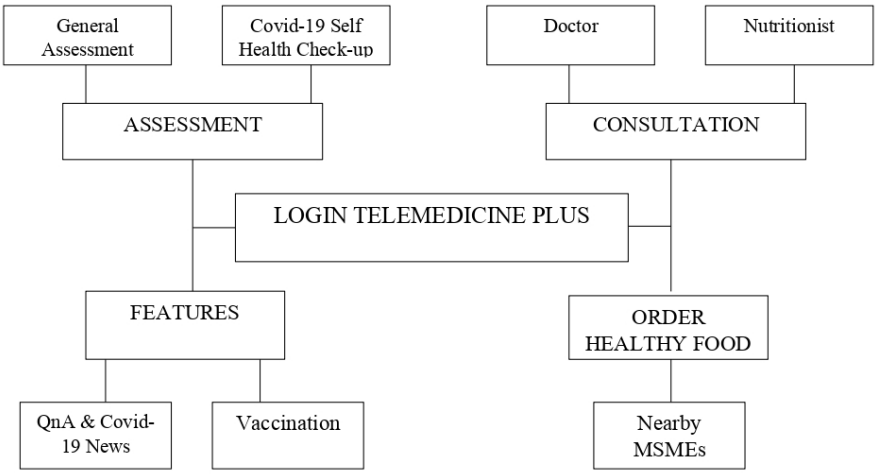

Chart 2. Telemedicine Plus Features

The Telemedicine Plus application development method uses a Software Development Life Cycle (SDLC) framework consisting of requirements analysis, design, application development, testing, and maintenance stages. The needs analysis stage was carried out through the FGD program with partners from the Ngoresan Public Healthcare Center, Tahu umma, and Mentari catering. After the system requirements are well identified, the next step is the design phase which consists of the design of the ERD (entity relationship diagram), UI (user interface,) and UX (User Experience). The third stage is application development, and the Telemedicine Plus application is developed using Progressive Web Apps (PWA), making it easier for users to access the application because it is cross-platform. In this stage, the development consists of developing a database, frontend, and back end as an implementation of the design stage. The independent health check menu was developed using an expert system, a Tsukamoto fuzzy logic, by looking at patients' temperature, respiratory rate, pulse frequency, and oxygen saturation based on age. The fourth stage is testing in the form of Testing and Quality Assurance which aims to test the functionality and non-functionality of the Telemedicine Plus application. At this stage, usability testing is also carried out, which has five aspects; learnability, efficiency, error, memorability, and satisfaction. The last stage is the maintenance of the system, which will continue to be carried out by the developer until the system is completely perfect and ready to be used by the user. The telemedicine plus application is designed using the progressive web apps method. It is intended that users can use it either through mobile applications or browsers. This application can be accessed via the URL www.pusline.com. The features of the telemedicine plus application are general check-ups, independent checks on Covid-19 status, consultations with doctors, Question and Answer sessions, Covid-19 news, nutritional consultations, and consultations regarding conditions while managing self-isolation. Apart from that, one feature that distinguishes this application from other telemedicine applications, namely the

healthy food message feature. So, during independent isolation, patients can order healthy food through this application. The existence of this feature is expected to improve the patient's nutritional status, thereby accelerating the healing process; following are screenshots of the telemedicine plus application display:

Picture 1. Application of Telemedicine Plus

Both groups were given the same treatment. The control group was given intervention following the Public Healthcare Center Standard Operating Procedure (SOP), which provides education related to Covid-19 using leaflet media. In contrast, the intervention group was given the Telemedicine Plus application. The treatment was carried out for 14 days. Respondents were assessed for quality of life on the first day of self-isolation. The intervention group respondents were asked to use the Telemedicine Plus application while undergoing self-isolation. In contrast, respondents in the control group were instructed to apply the knowledge provided by health workers. After 14 days of self-isolation, respondents from both groups were reassessed for their life quality using the SF 36 instrument.

A bivariate test was conducted to specify the difference in life quality before and after treatment in both groups. Before that, the researchers conducted a data normality test first. The result of the data normality test for the control group indicated that the data was distributed abnormally. The result of the pretest p-value was 0.057 (> 0.05), while the posttest p-value was 0.026 (< 0.05). Based on the result, the bivariate test used for the control group is a non-parametric test (Wilcoxon test). Meanwhile, in the intervention group, the normality test indicated that the data were normally distributed. The result of the pretest p-value was 0.96 (> 0.05), while the posttest p-value was 0.08 (> 0.05). Based on this result, the bivariate test used for the intervention group is the parametric test (Test Dependent t-test). Before the bivariate test to determine the distinction in life quality between both groups, the researcher also conducted a data normality test for the mean distinction between both groups. The results of the data normality test indicated that the data were normally distributed. The p-value in the intervention group was 0.076 (> 0.05), and the p-value in the control group was 0.059 (> 0.05). So, the bivariate test used in this research is the parametric test (Independent t-test).

RESULTS

Univariate Data

a. Characteristics of Respondents

Table 1 Characteristics of Respondents

No	Characteristics	Control Group		Intervention group		*p-value*
		Sum (n=30)	%	Sum (n= 30)	%	
1	Age Range					
	a. 12-16	1	3.3	-	-	0.58*
	b. 17-25	1	3.3	2	6.7	
	c. 26-35	5	16.7	6	20	
	d. 36-45	6	20	5	16.7	
	e. 46-55	4	13.3	5	16.7	
	f. 56-65	12	40	10	33.3	
	g. >65	1	3.3	2	6.7	
2	Gender					
	a. Man	17	56.7	20	66.7	0.11*
	b. Woman	13	43.3	10	33.3	
3	Comorbid					
	a. There is not any	21	70	21	70	0.96*
	b. Hypertension	4	13.3	3	10	
	c. Diabetes mellitus	2	66.7	1	3.3	
	d. Respiratory disorders	1	3.2	5	16.7	
	e. >2 comorbid	2	6.7	-	-	
4	Economic Status					
	a. High	3	10	9	30	0,63*
	b. Average	9	30	6	20	
	c. Low	18	60	15	50	

**homogeneity test*

Table 1 shows that the majority of participants in the control and intervention groups are in the range age of 56-65 years (40% in the control group and 33.3% in the intervention group), gender majority are male (56.7% in the control group and 66.7 in the control group), the majority participants had no comorbidities (70% in both groups). The economic status of participants was majority low (60% in the control group and 50% in the intervention group).

b. Quality of Life Score

Table 2 Life quality scores in the control group

Variable	Group	n	pretest		posttest	
			mean±SD	**Min-max**	**mean±SD**	**Min-max**
Quality of life	Control group	30	39.93±7.31	26-51	41.67±7.64	28-56
	Intervention group	30	39.70 ±9.44	26-59	50.93 ±12.8	27-79

Table 2 shows that the intervention group experienced an increase in the mean life quality score, which is higher than the control group.

Bivariate Data

a. Differences in quality of life scores before and after treatment

Table 3 Differences in quality of life scores before and after treatment

Variable	**Group**	**n**	**pretest**	**posttest**	**p-value**
			mean±SB	**mean±SB**	
Quality of life	Control group	30	39.93±7.31	41.67±7.64	0.06*
	Intervention group	30	39.70 ±9.44	50.93 ±12.8	<0.001**

**Paired t test, **Paired t test*

Table 3 represents the average quality of life score for respondents. Those who applied Telemedicine Plus application experienced an increase in the average life quality score from 39.70 to 50.93. At the same time, respondents who were given standard therapy through leaflets also showed an increase from 39.93 to 41.67. There is a significant difference in the quality of life scores in the intervention group, with a p-value of <0.001.

b. Differences in quality of life between the control group and the intervention group

Table 4 Differences in the quality of life scores of the control group and the intervention group

Group	**n**	**mean ±SD**	***mean diff***	***p-value***
Control group	30	1.73. **±4.97**	6.48	<0.001*
Intervention group	30	11.23 **±11.81**		

**independent-t-test*

Table 4 represents that the mean life quality score in the intervention group is greater than in the control group. The independent t-test indicated a p-value of <0.001 (<0.05). It shows a significant difference in the quality of life between the intervention group and the control group.

DISCUSSION

Most respondents were male (56.7% in the control group and 66.7% in the intervention group). It was also found in previous studies that the incidence of Covid-19 was more in male gender, with a percentage of 73% in the study of Huang et al. (2019), 67% in the study of Yang et al. and Chen et al. (2020).[11-13] Preliminary data analysis by WHO showed a relative distribution of infection among men at 51% and women at 47%.[14] The results of previous studies stated that men have a higher risk of contracting Covid-19 than women. Men's readiness to face the Covid-19 Pandemic is lower than women's.[15] A survey conducted by YouGov of men and women in the UK stated that 24% of men believed Covid-19 was the same as the common cold. Men also tend to be disobedient to government policies in breaking the chain of transmission of the Covid-19 virus.[16]

Most participants in the control and intervention groups were in the age range of 56-65 years (40% in the control group and 33.3% in the intervention group). In 2020, Yang et al. and Chen et al. also found that most respondents' average age was 59.7 years and 55.5 years.[12,13] The elderly have a high risk of contracting the Covid-19 virus. A weakened immune system and the presence of comorbidities support Covid-19 to aggressively attack the elderly.[17] Most participants had no comorbidities (70% in the control and intervention groups). Similarly, the research of Yang et al. (2020) and Huang et al. (2020) showed that 60% and 68% of the total study respondents had no comorbidities.[11,12] Although in the research of Chen et al. (2020), the percentage is slightly lower at 49%, the distribution is relatively the same.[13] Most of the respondents in this research were of low-income status (60% in the control group and 50% in the intervention). The existence of telemedicine helps accessibility to health services to be more effective and efficient and saves money.

The Covid-19 pandemic has had many negative impacts on health. Many people experience a decrease in quality of life, namely a very basic decline in physical, emotional, vitality, and social functions.[7,18,19] Not only that, but the pandemic also impacted non-health aspects, such as social and economic aspects. The policy of social restrictions and regional quarantine measures has the potential to limit the community's ability to carry out economic activities. As a result, during the Covid-19 pandemic, many people experienced a decline from an economic aspect. This economic downturn can have an impact on the utilization of health facilities, especially for people who do not have health insurance. As a result, the morbidity rate for Covid-19 has increased, and many Covid-19 patients cannot be treated quickly.[20,21]

Telemedicine is one of the solutions chosen by the government to deal with this problem, especially for handling Covid-19 patients undergoing independent isolation. Telemedicine is the implementation of remote nursing care by utilizing advances in information technology.[22] The results of previous studies stated that telemedicine is very suitable for monitoring and treating Covid-19 patients undergoing independent isolation.[23] The telemedicine plus application is a telemedicine application that provides not only remote nursing services but also has other features that other telemedicine applications do not have to support improving the quality of life of Covid-19 patients undergoing independent isolation. The advantage of the

Telemedicine Plus application is that it has seven main features that many other telemedicine applications do not have. The available features include general assessment, daily assessment, consultation with doctors regarding patient conditions, consultation related to nutrition, vaccine schedules, and information about Covid-19, as well as ordering healthy food.

The advantage of this general assessment feature is that health workers can use it as a source of initial information on the patient's condition. In the general assessment feature, patients are asked to upload proof of a positive test for Covid-19. General assessment results will be stored as electronic medical records. Patients can also check their health status during independent isolation using the self-assessment feature. The self-assessment results are treatment recommendations, whether the patient should continue independent isolation or need to be treated at a healthcare facility. The telemedicine plus application also has a healthy food message feature. It is intended for Covid-19 patients undergoing independent isolation, so they can consume healthy food to fasten the healing process. These are some of the features that make this telemedicine plus application different from previous telemedicine applications. These features aim to improve the patient's quality of life.

The results of measuring the quality of life using the SF-36 questionnaire showed that respondents who applied Telemedicine Plus experienced an increase in the average life quality score from 39.70 to 50.93. Respondents who received standard therapy through leaflets also experienced a life quality score from 39.93 to 41.67. Nevertheless, there was a significant difference in the life quality score in the intervention group with a p-value of <0.001, while in the control group, there was no significant difference in the life quality score. Based on that, telemedicine plus is recognized as a method for increasing the quality of life based on its unique advantages in defeating distance barriers between patients and healthcare professionals.

According to the SF-36 questionnaire, quality of life is divided into two major components, namely physical and psychological health.[24,25] Most of the respondents had symptoms such as headache, cough, anosmia, shortness of breath, and fever. A health worker must always monitor various symptoms that appear while the patient is carrying out independent isolation. For the group using the telemedicine plus application, patients can carry out a self-assessment if there is a sudden change in their health conditions using the self-assessment feature.[7]

The results of this examination are used as a guide for patients to carry out management at home, whether to remain in independent isolation or immediately get medical attention at a healthcare facility. Patients can also communicate with health workers regarding their condition. Patients are also given equipment to check their health: a thermometer and oximeter. In addition, the telemedicine plus application also provides Q and A sessions and Covid-19 news features, which can be accessed at any time. The purpose of this feature is that patients can carry out medication management properly and independently. This condition can improve the patient's psychological health. The results of several clinical trials have provided strong evidence for this view.[26] Telemedicine plus application can have many advantages, namely easy access, flexibility, being able to consult anywhere, the effectiveness of time, cost and effort. Patients do not need to travel far to health services that require a lot of time , fuel costs, and physically surviving through traffic jams to consult health problems with a doctor.

In contrast to the intervention group, management to improve physical and psychological health was still not optimal in the control group. Patients could not carry out self-assessment independently as in the intervention group. Patients also cannot communicate online with health workers. Information about management during self-isolation is only provided through leaflets. The results of previous studies also stated that telemedicine is appropriate for Covid-19 patients with mild symptoms and minimizes exposure to other patients.[27]

In terms of service delivery capacity, the telemedicine plus application provides effective, fast and efficient services. The health service process is also shorter. Patients do not need to go to a health facility or endure long queues to get health services. Health workers also benefit more from this application because they can provide maximum services even though the services provided are remote. Whereas in conventional methods, the capacity of service delivery is limited. It is supported by the policy limiting visits to health facilities during the Covid-19 Pandemic. Previous research results suggest many potential benefits of telehealth, including increased access to care, increased productivity for healthcare providers and patients through reduced travel, potential cost savings, and opportunities to develop culturally appropriate services that are more sensitive to the needs of special populations. Telehealth uptake is sometimes limited by physician reluctance and policies that hinder the metropolitan population from accessing telehealth services.[28]

The telemedicine plus application makes it easier and safer for health workers to interact with patients. It creates a good and sustainable relationship between patients and health workers, especially for patients undergoing independent isolation. Telemedicine plus application can also improve the quality of care at home. In the control group, patients had to go to a health facility first to consult or get other health services. The results of previous research stated that telehealth applications could be used to protect consumers and health service providers by providing services through remote consultation mode.[29]

CONCLUSION

This research concludes that the Telemedicine Plus application significantly affects the quality of life of Covid-19 patients who are going through self-isolation. This study identified that Telemedicine Plus applications improved the life quality of patients compared to patients who were given standard therapy.

RECOMMENDATIONS

This study recommends that the Telemedicine Plus application is an alternative intervention for Covid-19 patients undergoing self-isolation to improve their quality of life. Future research should use a larger sample and develop other features in Telemedicine Plus applications.

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