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THE EFFECT OF M-HEALTH UTILIZATION WITH AUDIOVISUAL EDUCATION APPROACH ON TREATMENT ADHERENCE BEHAVIOR IN TUBERCULOSIS PATIENTS

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ABSTRACT
In Indonesia, the success rate of TB treatment in 2023 has not yet reached the national target. Treatment of TB aims to cure the patient, prevent death, and prevent drug resistance. However, patients often fail to adhere to treatment due to the lengthy treatment period and side effects of the medication. The utilization of M-Health as a medium for audiovisual education is one of the efforts that can be made to improve treatment adherence behavior. The purpose of this study is to determine the effect of utilizing WhatsApp-based M-Health with an audiovisual education approach on treatment adherence behavior, reviewed from the aspects of knowledge, attitude, and action, in tuberculosis patients. This study uses a Quasi-experimental design with a pre-test and post-test with control group design. The sample in this study consisted of TB patients undergoing Anti-Tuberculosis treatment in North Bolaang Mongondow Regency, with a total of 80 respondents, comprising 40 treatment group respondents and 40 control group respondents. The sample was selected using the purposive sampling technique. The research instrument used was a questionnaire administered to respondents to measure their knowledge, attitudes, and action. Statistical analysis was conducted using Paired t-test, Wilcoxon signed-rank test, and Mann-Whitney test. The results of this study indicated a statistically significant difference in knowledge, attitude, and action scores pre- and post-intervention ($p = 0.000$). Additionally, the Mann-Whitney test demonstrated a significant difference in knowledge, attitude, and action between the intervention and control groups ($p = 0.000$). The utilization of M-Health with an audiovisual education approach has a positive impact on improving treatment adherence behavior in terms of knowledge, attitude, and action.

Keywords: audiovisual education; behavior; m-health; tuberculosis treatment adherence; whatsapp

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INTRODUCTION

Tuberculosis (TB) is the most prevalent infectious disease, affecting multiple systems and presenting with diverse clinical manifestations, including mortality. Despite being preventable and curable, TB remains the second leading cause of death worldwide due to a single infectious agent in 2022, and continues to be a major global health problem, particularly in developing countries (WHO, 2023). In an effort to end the TB epidemic, all United Nations (UN) member states have agreed to achieve the target of TB elimination by 2030. In Indonesia, according to the 2024 report from the Ministry of Health of the Republic of Indonesia, the estimated incidence of TB is approximately 1.060.000 cases, with a mortality rate of 23.858 deaths due to TB. This mortality rate shows an increasing trend compared to previous historical data. While the coverage of the TB treatment success program in 2023 only reached 87%, this figure falls short of the central government's target of 90%. Treatment for TB involves a combination of several types of medications taken in precise doses and quantities over a period of 6-8 months to kill all TB bacteria. The goal of this treatment is to cure the patient, prevent death, and prevent drug resistance. However, patients often fail to

adhere to treatment due to the lengthy treatment period and medication side effects (Adhanty & Syarif, 2023).

According to data from the Bolaang Mongondow Utara Health Department in 2024, the number of TB patients reached 222. Meanwhile, the treatment success rate for TB in North Sulawesi Province remains at 80%, which is still below the central government's target. The TB treatment dropout rate in North Bolaang Mongondow Regency is below 10%, which is within the national threshold. Nevertheless, this issue still requires attention. Based on interviews with the TB treatment program manager at the health department, the failure of treatment and treatment dropout are largely due to non-adherence to treatment. Many patients fail to adhere to their daily medication regimen, forget to take their weekly medication, neglect their treatment, and lack knowledge and motivation to complete their treatment. Various studies have been conducted to improve health behavior, including a study by Pereira (2020) which revealed that using WhatsApp groups for health education among women is a potential strategy in breast cancer control. Another study by Nagaraj et al. (2019) concluded that video education resulted in positive improvements in adherence to tuberculosis treatment in India.

Efforts to improve adherence to tuberculosis treatment among patients have been implemented at community health centers in North Bolaang Mongondow, including direct education and education using leaflet media (Dinkes Bolmut, 2024). However, the education efforts made have several weaknesses, such as limited time, inadequate education intensity, long distances between health facilities and patients' homes, and ineffective education media in improving TB treatment adherence. Adherence to treatment has become a challenge for tuberculosis control programs. With the advancement of digital technology, it is necessary to utilize technology in the health sector, particularly to improve adherence to treatment. One possible solution is to utilize M-Health as a medium for providing education. One of the M-health platforms that can be utilized is WhatsApp. The WhatsApp application provides various features to facilitate communication, including sending text messages, voice and video calls, as well as sharing multimedia files (Giansanti, 2020). WhatsApp, used as a medium for delivering audiovisual educational content, provides flexibility in education delivery, allowing it to be accessed anytime and anywhere, thereby greatly facilitating educational activities (Pakhri, 2017). Furthermore, audiovisual education makes learning more engaging, informative, and effective by presenting moving images accompanied by sound, thereby enhancing the learning process (Baitipur & Widraswara, 2018), Therefore, this can influence changes in treatment adherence behavior. Further research is needed to determine the effectiveness of M-Health in improving TB treatment adherence, particularly in terms of ease of access and use of mobile health applications for TB patients (Suraya et al., 2022). Based on the above background, the author conducts research aimed at determining the effect of M-Health utilization with an audiovisual education approach on treatment adherence behavior, reviewed from the aspects of knowledge, attitude, and action, among tuberculosis patients in North Bolaang Mongondow Regency.

METHOD

This study uses a Quasi-experimental design with a pre-test and post-test with control group design. The population in this study consists of all tuberculosis patients undergoing Outpatient Anti-Tuberculosis Treatment (OAT) in North Bolaang Mongondow Regency. A total of 80 respondents were sampled, with 40 respondents in the treatment group and 40 respondents in the control group. The treatment group in this study received an intervention utilizing M-Health (WhatsApp application) with an audiovisual education approach. This intervention was conducted by initially administering a pre-test, followed by adding the

respondents to a WhatsApp group. In the first week, respondents were sent educational videos shared through the WhatsApp group, which they were required to download and watch once a week for three weeks. Subsequently, weekly reminder messages were sent to the respondents through the WhatsApp group to remind them to watch the provided educational videos. To monitor and ensure that respondents had watched the video or not, a WhatsApp group polling was sent to them every week. Respondents were asked to choose one of the two available options: "Have watched the video" or "Have not watched the video. Meanwhile, the control group only received standard health services from the community health center. Both groups underwent measurements of treatment adherence behavior, which was reviewed from the aspects of knowledge, attitude, and action, before and after the intervention. Sample determination used a purposive sampling technique and was in accordance with the inclusion and exclusion criteria. The instrument used was a questionnaire that had met the validity test (2-tailed Sig < 0.05) and reliability test (Cronbach's Alpha > 0.7) to measure knowledge, attitudes, and actions. The data analysis used to evaluate the differences between pre-test and post-test used Paired t-test and Wilcoxon test. Furthermore, the Mann-Whitney test was used to compare the treatment group and control group.

RESULT

The respondents were TB patients undergoing Outpatient Anti-Tuberculosis Treatment (OAT) in North Bolaang Mongondow, totaling 80 people, divided into two groups: 40 respondents in the treatment group and 40 respondents in the control group

Table 1.
Distribution of characteristics of respondents in the treatment group and control group (n = 40)

Characteristics		Intervention group		Control group		Total	
		f	%	f	%	f	%
Gender	Male	25	62.5	28	70	53	66.3
	Female	15	37.5	12	30	27	33.8
	Total	40	100	40	100	80	100
Age	17-25	9	22.5	4	10	13	16.3
	26-35	6	15	5	12.5	11	13.8
	36-45	5	12.5	4	10	9	11.3
	46-55	10	25	13	32.5	23	28.8
	56-65	10	25	14	35	24	30
	Total	40	100	40	100	80	100
Educational Background	No education	0	0	1	2.5	1	1.3
	Elementary School	11	27.5	13	32.5	24	30
	Junior High School	9	22.5	9	22.5	18	22.5
	Senior High School	14	35	13	32.5	27	33.8
	University	6	15	4	10	10	12.5
	Total	40	100	40	100	80	100
Occupation	Not working	16	40	14	35	30	37.5
	Working	24	60	26	65	50	62.5
	Total	40	100	40	100	80	100
Side Effects of OAT	No effect	21	52.5	20	50	41	51.3
	Has an effect	19	47.5	20	50	39	48.8
	Total	40	100	40	100	80	100
Distance from home to health facility	< 10 Km	29	72.5	30	75	59	73.8
	≥ 10 Km	11	27.5	10	25	21	26.3
	Total	40	100	40	100	80	100

Table 1. shows that the majority of respondents in the treatment and control groups were male (treatment 62.5%, control 70%), aged 55-65 years (treatment 25%, control 35%), had a senior

high school education (treatment 35%, control 32.5%), were employed (treatment 60%, control 65%), had no OAT effects (treatment 52.5%, control 50%), and lived within 10 km of health facilities (treatment 72.5%, control 75%).

Table 2.
Distribution of knowledge, attitude, and action scores before and after intervention (n=40)

Variables		Intervention group				Control group			
		Pre test		Post test		Pre test		Post test	
		f	%	f	%	f	%	f	%
Knowledge	Good	15	37.5	31	77.5	12	30	17	42.5
	Fair	25	62.5	9	22.5	27	67.5	23	57.5
	Poor	0	0	0	0	1	2.5	0	0
	Total	40	100	40	100	40	100	40	100
Attitude	Good	29	72.5	39	97.5	28	70	31	77.5
	Poor	11	27.5	1	2.5	12	30	9	22.5
	Total	40	100	40	100	40	100	40	100
Action	Good	13	32.5	31	77.5	15	37.5	21	52.5
	Fair	25	62.5	8	20	22	55	15	37.5
	Poor	2	5	1	2.5	3	7.5	4	10
	Total	40	100	40	100	40	100	40	100

Table 2. shows that respondents in both the treatment and control groups experienced improvements in knowledge, attitude, and action. The average increase occurred in respondents with good categories, while respondents with fair and poor categories experienced a decrease. The greatest improvement was found in the treatment group's knowledge aspect with good category, increasing from 37.5% in the pre-test to 77.5% in the post-test.

Table 3.
Analysis of knowledge, attitude, and action scores before and after intervention (n=40)

Variables	Group	Pre test	Post test	p-value
		Mean±SD/ Median (min-max)	Mean±SD/ Median (min-max)	
Knowledge	Intervention	28.70±4.033’	32.52±3.226’	0.000*
	Control	27.38±4.004’	28.82±4.163’	0.000*
Attitude	Intervention	6 (2-8)”	7 (4-8)”	0.000**
	Control	6 (3-8)”	6 (3-8)”	0.011**
Action	Intervention	13 (9-16)”	14.5 (10-16)”	0.000**
	Control	13 (9-16)”	14 (9-16)”	0.022**

‘ Mean±SD “ Median (min-max) *Uji Paired t test **Uji wilcoxon

Table 3. shows the results of statistical tests, indicating a significant difference in knowledge (p = 0.000), attitude (p = 0.000), and action (p = 0.000) before and after intervention in the treatment group. Similarly, in the control group, there was a significant difference in knowledge (p = 0.000), attitude (p = 0.011), and action (p = 0.022) before and after intervention.

Table 4.
Comparative analysis between treatment and control groups (n = 40)

Variables	Intervention group				Control group				p-value
	f	Median	Min	Max	n	Median	Min	Max	
Knowledge	40	3.82	0	8	40	1.45	-3	7	0.000*
Attitude	40	1.25	-1	3	40	0.32	-2	2	0.000*
Action	40	1.50	-1	4	40	0.28	-1	2	0.000*

* Uji manny-whitney

Table 4. shows that there is a significant difference between the treatment and control groups in terms of the median difference in knowledge (p = 0.000), attitude (p = 0.000), and action (p

= 0.000). Furthermore, the median values of knowledge, attitude, and action in the treatment group (3.82) were higher compared to the control group (1.45), indicating that the treatment group experienced a greater increase.

DISCUSSION

The Effect of M-Health Utilization with Audiovisual Educational Approach on Treatment Adherence Behavior Reviewed from the Aspect of Knowledge

The results of the study indicate that the treatment group experienced an increase in respondents' knowledge. The mean score before intervention was 28.70, which increased to 32.52 after intervention. The results of statistical analysis showed a p-value of 0.000, indicating a significant difference in knowledge levels between pre- and post-intervention in the treatment group. Consequently, the results indicate a significant improvement in knowledge among the treatment group following the intervention utilizing M-Health WhatsApp with audiovisual education. These findings are consistent with the study conducted by Khayati et al. (2019), which showed that patients who received video education experienced a significant increase in knowledge from pre-test to post-test (p-value = 0.000). Every human being receives or captures knowledge through their five senses, following the principle of media preparation. The more senses used to perceive something, the greater and clearer the understanding or knowledge received (Notoatmodjo, 2010). As a result, video media, which stimulates two senses, namely sight and hearing, provides a clearer understanding and knowledge compared to text-based media, which only stimulates one sense (Rohman, 2015). According Notoatmodjo (2010), an individual's knowledge is formed by both internal factors such as interest, intelligence, and physical health, as well as external factors including environmental influences such as family, community, and access to health facilities, infrastructure, and effective learning strategies and methods. The media used has a significant impact on the effectiveness of health education. Education can enhance knowledge, especially when using multimedia formats such as films or interactive games that engage multiple senses (Latif & Tiala, 2022). Providing educational videos via WhatsApp has shown greater effectiveness in increasing knowledge compared to conveying information through leaflets (Jailobaev et al., 2021). By utilizing WhatsApp, information can be delivered flexibly, anytime and anywhere, making it highly beneficial for nutrition education activities (Pakhri, 2017). Pereira, (2020) revealed that using WhatsApp groups for health education among women is a potential strategy in breast cancer control, as it provides a space for sharing experiences and information. This study explored the potential of WhatsApp as a tool for promoting knowledge sharing about health, and demonstrated that its benefits can be extended to other health campaigns. WhatsApp is not just a trendy application, but also has great potential to support the learning and education process. The use of WhatsApp in education has advantages because it can convey information through audio and visual means, making it easier for mothers to understand and remember information.

In the control group, the average knowledge score before intervention was 27.28, increasing to 28.82 after intervention. Statistical analysis revealed a p-value of 0.000 for the control group, indicating a significant difference in knowledge levels between pre- and post-intervention. The control group in this study received standard care provided by the community health center, which included direct counseling and education, resulting in changes in knowledge among the control group. However, the increase in knowledge was not greater than the increase in the intervention group, which received standard community health center care plus audiovisual education via WhatsApp. Furthermore, the Mann-Whitney test revealed a significant difference (p = 0.000) in the median difference in knowledge scores between the treatment and control groups, with a higher median difference observed in the treatment group (3.82) compared to the control group (1.45). This indicates that the treatment

group experienced a greater increase in knowledge compared to the control group. Therefore, the intervention using M-Health WhatsApp with an audiovisual educational approach has an impact on treatment adherence behavior in terms of knowledge. The results of this study are consistent with the research conducted by Wardhana et al. (2023), which found that audiovisual media is more effective than visual brochures in improving oral health knowledge among adolescents.

According to the author, the difference in knowledge between the treatment and control groups was influenced by the method of education, in this case, the treatment group received audiovisual education in the form of videos that could stimulate sight and hearing. The education provided using these videos had a greater appeal because they presented moving images or animations combined with explanatory audio about tuberculosis treatment. This video was created by the author and has undergone content and media validation tests, making it suitable as an educational material. The education presented in the video contains information compiled from previous videos and materials from various sources, carefully crafted to be easily understood. Moreover, the video-based education was facilitated by the utilization of the WhatsApp application, which enables users to share information and media, such as images, videos, files, and more, with others without spatial or temporal limitations. One of the challenges faced by healthcare workers in providing education to tuberculosis patients is that education is typically provided in person, requiring more effort as healthcare workers must speak directly with patients, and only if patients visit the healthcare facility. If not, healthcare workers must make an effort to visit the patient's home to provide counseling and education. With the utilization of WhatsApp, providing education has become easier, can be done anywhere and anytime, and with the ease of education provision through WhatsApp, patients can receive intensive and continuous education on a weekly basis, allowing their knowledge and understanding to develop as expected. Meanwhile, the control group only received standard services, which in this case was direct education. This is what made the greater impact found in the intervention group.

The Effect of M-Health Utilization with Audiovisual Educational Approach on Treatment Adherence Behavior, Reviewed from the Aspect of Attitude

The study results showed that in the treatment group, the respondents' attitudes improved. The median value increased from 6 to 7 after the intervention. Statistical analysis revealed a p-value of 0.000 for the treatment group, indicating a significant difference in attitude levels before and after the intervention. This indicates that a significant improvement in knowledge was observed in the treatment group following the intervention utilizing M-Health WhatsApp with an audiovisual educational approach. This study is in line with the research conducted by Hayati *et al*, (2020), which found that video-based learning media had a positive impact on improving attitudes related to mask use among family members living with confirmed TB patients. Newcomb defines attitude as an individual's readiness to act, which is influenced by their level of knowledge. An individual's attitude is influenced by several factors, including personal experiences, interactions with others, culture, mass media, and emotional conditions (Azwar, 2011). Through their experience participating in health education via video education, respondents gained additional knowledge that served as a foundation for determining their attitudes. Health education provided to TB patients can increase their knowledge and awareness of the importance of adhering to treatment programs (Khayati *et al*., 2019). Furthermore, Saengow et al. (2018) empirically demonstrated that animated educational films improved medication understanding among individuals with epilepsy. Animated videos are highly effective in health education, as they are artistically engaging, easy to understand, informative, and effective in enhancing health knowledge. Another study that supports this finding is by Fitriadi et al. (2021), which found that foot care education through digital media, such as WhatsApp groups, can improve knowledge and practice of foot

care among diabetic patients. Education through WhatsApp groups has a positive impact on knowledge and foot care practices. WhatsApp groups have also been proven to be effective in facilitating communication and accelerating decision-making (Pereira, 2020).

Meanwhile, in the control group, the median attitude value did not show any changes, with a median value of 6 both before and after the intervention. However, statistical analysis revealed that the attitude of the control group respondents improved (p-value 0.011 < 0.05). The control group in this study received standard care provided by the community health center, which included direct counseling and education, resulting in a change in attitude among the control group. Furthermore, the Mann-Whitney test revealed a significant difference (p = 0.000) in the attitude difference scores between the treatment and control groups, with a higher median difference in the treatment group (1.25) compared to the control group (0.32). This indicates that the treatment group experienced a greater increase compared to the control group. Therefore, the intervention using M-Health WhatsApp with an audiovisual educational approach has an impact on treatment adherence behavior in terms of attitude. The results of this study are consistent with the research conducted by Aslim et al. (2024), which found that education through animated videos using the WhatsApp application had an impact on the knowledge and attitudes of TB patients regarding medication use between the intervention and control groups.

According to the author, the difference in knowledge between the treatment and control groups was influenced by the method of education delivery, in this case, the treatment group received audiovisual education in the form of videos. The videos provided contained strategic information on treatment, particularly on how to view or approach treatment. Furthermore, providing information through WhatsApp offers flexibility, and information can be disseminated quickly and accurately simply by sending it through a WhatsApp group. The video will then be received by all patients within seconds or minutes, depending on the internet connection. This efficient educational delivery method will facilitate patients' ability to respond to various conditions related to their treatment earlier, at the beginning of treatment, allowing positive attitudes to form and develop until the completion of treatment. The utilization of WhatsApp makes educational delivery easier, accessible anywhere and anytime, and also enables continuous and intensive education for patients through weekly sessions, resulting in the formation of knowledge, understanding, and attitudes as expected. In contrast, the control group only received standard care, which included direct education. This is what led to a greater impact being observed in the intervention group.

The Effect of M-Health Utilization with Audiovisual Educational Approach on Treatment Adherence Behavior, Reviewed from the Aspect of Action

The research results show that the respondents' actions in the treatment group increased. The median value of the treatment group increased from 13 to 14.50 after the intervention. The results of the statistical analysis showed that the p-value for the treatment group was 0.000 < 0.05, indicating a significant difference in action levels between before and after the intervention. The above results demonstrate how the respondents' actions changed for the better, both before and after receiving the M-Health WhatsApp intervention with an audiovisual educational approach. The aforementioned findings are consistent with the study conducted by Wati et al. (2017) which demonstrated that video-based health education significantly improved students' adherence to handwashing with soap. Another study conducted by Baitipur & Widraswara (2018) emphasized that the use of video media in health education can stimulate active participation from respondents because they can directly observe and understand the message content. Changes in knowledge among the target audience can be achieved through health education that uses engaging media, such as videos that combine moving images and sound, making it easier for the target audience to understand

the information being conveyed. Similarly, another study by Jannah & Murni (2019) observed an increase in adherence to consuming iron supplements among pregnant women from pre-test to post-test, after being given an intervention through audio-visual media. WhatsApp can serve as an effective reinforcement to enhance adherence to therapy. Many people prefer WhatsApp as a medium for education, including health education, due to the various facilities and conveniences it offers (Rathbone et al., 2020). A study by Pandya (2020) employed a similar approach, utilizing WhatsApp-based interventions featuring Mindful Eating (ME) posts, and found it to be effective in supporting adolescents with food allergies.

Meanwhile, in the control group, the median action score showed a change, with a median score of 13 before the intervention increasing to 14 after the intervention. However, upon closer inspection, the increase in median score in the control group was not greater than that in the treatment group. Statistical analysis revealed that the action of the respondents in the control group improved (p-value 0.022 < 0.05). The control group in this study received standard care provided by the community health center, which included direct counseling and education, resulting in a change in actions among the control group. Furthermore, the results of the Mann-Whitney test revealed a significant difference (p = 0.000) in the mean difference in actions between the treatment and control groups, with a higher median difference observed in the treatment group (1.50) compared to the control group (0.28). This indicates that the treatment group experienced a greater increase compared to the control group. Therefore, the M-Health WhatsApp intervention with an audiovisual educational approach has an impact on treatment adherence behavior in terms of action.

According to the author, the difference in actions between the treatment and control groups was influenced by the method of education, in this case, the treatment group received audiovisual education in the form of videos. Health education as a stimulus causes individuals to evaluate and form opinions about what they know or believe, and subsequently, it is expected that they will implement health practices or actions, or what is referred to as health behavior. The video provided contains strategic information for treatment, and also includes motivational words for recovery. Moreover, providing information through WhatsApp offers flexibility, allowing information to be delivered frequently due to the ease of sending videos. The more frequently educational videos are watched, the deeper the patient's understanding of the information contained in the video. The utilization of WhatsApp facilitates education delivery, enabling patients to receive intensive and continuous education on a weekly basis, thereby shaping their knowledge, understanding, attitudes, and actions as desired. In this study, the videos sent via WhatsApp were delivered once a week for three weeks, providing respondents with sufficient time to respond and change their behavior or actions related to their treatment. In contrast, the control group only received standard care, which in this case was direct education. This is likely the reason why the intervention group had a greater impact.

CONCLUSIONS

The utilization of M-Health with an audiovisual educational approach has a positive impact on increasing treatment adherence behavior, as seen from the aspects of knowledge, attitudes, and actions. Therefore, this intervention can be used by healthcare workers to provide health education to TB patients, with the aim of improving treatment adherence behavior.

REFERENCES

Adhanty, S., & Syarif, S. (2023). Kepatuhan Pengobatan pada Pasien Tuberkulosis dan Faktor-Faktor yang Mempengaruhinya: Tinjauan Sistematis. Jurnal Epidemiologi Kesehatan Indonesia, 7(1), 7. https://doi.org/10.7454/epidkes.v7i1.6571

Aslim., Thaha, R. M., Syafar, M., Riskiyani, S., & Salmah, A. U. (2024). The Impact of WhatsApp Social-Media on Tuberculosis Treatment Compliance at Banabungi Community Health Center in Buton Regency , Southeast Sulawesi. International Journal of Chemical and Biochemical Sciences (ISSN 2226-9614), 25(13), 399–406. https://www.iscientific.org/wp-content/uploads/2024/01/48-IJCBS-24-25-13-48.pdf

Azwar, S. (2011). Sikap Manusia: Teori dan Pengukurannya. Yogyakarta: Pustaka Pelajar.

Baitipur, Listya Nisa; Widraswara, R. (2018). Pendidikan Kesehatan melalui Video untuk Meningkatkan Pengetahuan dan Praktik PSN DBD. Journal of Health Education, 3(2), 86–90. https://doi.org/10.15294/jhe.v3i2.17444

Dinkes, B. mongondow utara. (2024). Profil Kesehatan Kabupaten Bolaang Mongondow Utara.

Fitriadi, Y., Kusnanto, H., & Danawati, C. W. (2021). Impact of Foot Care Education Program Using WhatsApp Group on Knowledge and Foot Care Practice in Diabetic Patients. 42–48. https://doi.org/10.22146/rpcpe.65439

Giansanti, D. (2020). WhatsApp in mHealth: an overview on the potentialities and the opportunities in medical imaging. In mHealth (Vol. 6). AME Publishing Company. https://doi.org/10.21037/mhealth.2019.11.01

Hayati, Y. S., Putri, V. A., & Lukitasari, M. (2020). The Effectiveness Of Lung Tuberculosis Educational Video To Increase Knowledge And Attitudes Of Masks Use In Families Living With Tuberculosis Patients. Journal of Nursing Science 2020 Vol. 8, No. 2, 129-134, 8(2), 129–134. https://doi.org/10.21776/ub.jik.2020.008.02.10

Jailobaev, T., Jailobaeva, K., Baialieva, M., Baialieva, G., & Asilbekova, G. (2021). WhatsApp Groups in Social Research: New Opportunities for Fieldwork Communication and Management. BMS Bulletin of Sociological Methodology/ Bulletin de Methodologie Sociologique, 149(1), 60–82. https://doi.org/10.1177/0759106320978337

Jannah, Muslihatul; Murni, N. N. A. (2019). Penggunaan Media Audio Visual Meningkatkan Kepatuhan Konsumsi Tablet Tambah Darah pada Ibu Hamil. Jurnal Kesehatan Prima, 13(2), 108–114. http://dx.doi.org/10.32807/jkp.v13i2.235

Kemenkes. (2024). Dashboard Public Private Mix (PPM) Tuberkulosis Indonesia. Www.Tbindonesia.or.Id. https://www.tbindonesia.or.id/dashboard-ppm/

Khayati, F. N., Mulyani, E. S., & Purnomo, R. T. (2019). Pengaruh Edukasi Dengan Media Video Terhadap Pengetahuan, Sikap Dan Kepatuhan Berobat Pada Penderita TB Paru Di Balkesmas Wilayah Klaten Fitriana. The 12th University Research Colloqium 2020 Universitas 'Aisyiyah Surakarta, 1(69), 5–24. http://repository.umkla.ac.id/id/eprint/1683

Latif, A. I., & Tiala, N. H. (2022). Efektivitas Video Edukasi Melalui Whatsapp Dalam Meningkatkan Pengetahuan Tentang Pencegahan Penularan Pasien Tuberkulosis Paru. Jurnal Kesehatan, 14(2), 111. https://doi.org/10.24252/kesehatan.v14i2.24920

Nagaraj, K., Prithviraj, R., Ramesh, R. M., Maheswaran, R., Narasimhaiah, S., & Akshaya, K. M. (2019). Effectiveness of Health Education Video in Improving Treatment Adherence among Patients with Tuberculosis: An Interventional Study from Bengaluru, India. Journal of Tuberculosis Research, 07(03), 159–169.

https://doi.org/10.4236/jtr.2019.73016

Notoatmodjo. (2010). Ilmu Perilaku Kesehatan. Rineka Cipta.

Pakhri, A. (2017). Pengaruh Edukasi Gizi terhadap Pengetahuan Gizi dan Asupan Energi, Protein dan Besi Pada Remaja. Media Kesehatan Politeknik Kesehatan Kemenkes Makassar, 39–43. https://doi.org/10.32382/medkes.v13i1.97

Pandya, S. P. (2020). Adolescents Living with Food Allergies in Select Global Cities: Does a WhatsApp-Based Mindful Eating Intervention Promote Wellbeing and Enhance their Self-Concept? Journal of Pediatric Nursing, 55, 83–94. https://doi.org/10.1016/J.PEDN.2020.06.014

Pereira, A. A. C. (2020). Effects of a WhatsApp-Delivered Education Intervention to Enhance Breast Cancer Knowledge in Women : Mixed-Methods Study Corresponding Author : Jmir Mhealth And Uhealth, 8(7). https://doi.org/10.2196/17430

Rathbone, A. P., Norris, R., Parker, P., Lindsley, A., Robinson, A., Baqir, W., Campbell, D., & Husband, A. (2020). Exploring the use of WhatsApp in out-of-hours pharmacy services: A multi-site qualitative study. Research in Social and Administrative Pharmacy, 16(4), 503–510. https://doi.org/10.1016/J.SAPHARM.2019.06.019

Rohman, F. N. (2015). Pengaruh Penyuluhan Menggunakan Media Animasi terhadap Pengetahuan Personal Hygiene pada Siswa di Mi Negeri Baki Sukoharjo. Universitas Muhammadiyah Surakarta.

Saengow, V. E., Chancharoenchai, P., Saartying, W., Pimpa, W., Chotichanon, N., Lewsirirat, T., & Srisantisuk, P. (2018). Epilepsy video animation: Impact on knowledge and drug adherence in pediatric epilepsy patients and caregivers. Clinical Neurology and Neurosurgery, 172, 59–61. https://doi.org/10.1016/J.CLINEURO.2018.06.031

Suraya, A. S., Jannah, F., Erindia, F., Nurwahidah, N. N., & Chayatush Sholichah, A. (2022). The Usability and Impact of Mobile Health Applications on Tuberculosis treatment regimen: A Systematic Review. *Fundamental and Management Nursing Journal*, *5*(2), 55–65. https://doi.org/10.20473/fmnj.v6i1.48757

Wardhana, E. S., Ratnawati, I. D., Failasufa, H., & Balqis, I. (2023). A Comparative Analysis of the Impact of Audiovisual and Leaflets through Whatsapp as Oral Health Promotion Media on Adolescents' Knowledge of Oral Health. South Eastern European Journal of Public Health, 21(Xxi), 181–188. https://doi.org/10.70135/seejph.vi.453

Wati, Nasyrah; Yuniar, N. P. (2017). Pengaruh Intervensi Penayangan Video terhadap Pengetahuan, Sikap dan Tindakan Tentang Cuci Tangan Pakai Sabun Pada Siswa Sdn 10 Kabawo. Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat Vol. 2/NO.5/ Januari 2017; ISSN 250-731X, 2(5), 1–12. http://dx.doi.org/10.37887/jimkesmas.v2i5.2091

WHO. (2023). Global Tuberculosis Report 2023. WHO publications. https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2023