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Effective Visual Media to Increase Knowledge and Comprehension of Multidrug Resistant Tuberculosis Among Patients and Their Caregivers

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Abstract

Indonesia ranks third among countries with the largest number of TB cases after India and China. Globally, more than 3-4% of all TB cases are Multidrug-Resistant Tuberculosis (MDR TB). MDR TB is a more complicated TB that needs extra treatments, which extend treatment time and increase adverse effects. Thus, MDR TB patients and their families often feel demotivated about completing treatment, leading to loss to follow up, which contributes to the never-ending transmission and greatly affects the success rate of the national TB control program. Thus, better knowledge and perception on MDR treatment for patients and families plays a crucial role in dealing with this issue. A cross-sectional study was performed from April to June 2019 to evaluate the effectiveness of visual educational media for TB patients and their caregivers. Participants consisted of 144 patients diagnosed with MDR TB and their caregivers or family members (n=22). A pre-test was administered before an education session by a nurse and visual media were used as the educational material. At the end of the session, a post-test was performed. The post-test score was then compared to the pre-test score to evaluate the session's effectiveness using the paired t-test. Result showed significant increase in the post-test score (t= 3.249, df=3, p=0.04), with the caregivers attained a higher score, showing better improvement in knowledge after the session compared to the patient group. Hence, the MDR TB educational intervention using visual media is considered effective to increase participants 'understanding of MDR TB. It is expected that with increased knowledge on MDR TB, the treatment success rate will increase and becomes the catalyst for the nationwide TB control strategy.

Keywords: Multidrug resistant tuberculosis, MDR TB knowledge, MDR TB education, visual educational media

Introduction

Tuberculosis is the leading infectious disease killer in the world and still a major public health concern in Indonesia, which ranks third worldwide (8.4% of the total population are infected) for high-burden TB nations, after India (26%) and China (8.5%). According to Global Report, 10 million individuals became ill with TB in 2021, with 3.3% being Multidrug-Resistant Tuberculosis (MDR TB).[1] MDR-TB usually occurs for one or two reasons. It can happen when strict medication regimens are not applied to a patient. This can be due to incorrectly prescribed regimens, ineffective medication, or interruption in medication (full medication regimen is not completed). These reasons are also known as treatment failure. MDR -TB can also happen when the disease is transmitted from person to person.[2] MDR TB usually rises resistance in first-line tuberculosis drugs, including Rifampicin, Isoniazid, Pyrazinamide, and Ethambutol.[3] As substitutes, second-line drugs, include, for example, include levofloxacin, moxifloxacin, bedaquiline, delamanid and linezolid, are given during the treatment, which need longer duration, greater side effects, and higher treatment cost. This condition often demotivates patients to finish the treatment. It gives birth to dropout (DO) patients and various complications. It allows the disease to continue

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to be transmitted.[4] Moreover, the DO rate among MDR TB patients is much higher than in primary sensitive TB patients.

MDR-TB remains a public health crisis and a health security threat. Only about one in three people with drug-resistant TB accessed treatment in 2020. Worldwide in 2018, the treatment success rate of MDR/RR TB patients was 59%. Besides the patient's complete TB medication, a successful MDR TB treatment is also determined by TB national control strategy, quality and accessibility of health facilities, and TB drug stock and distribution.[3] Mental aspects such as knowledge and perception are crucial in infectious disease control and care.[4] They help igniting patient's positive behaviour management to achieve treatment success.[3,5].

Unfortunately, the approaches to successful treatment management, including education about the disease, are commonly misunderstood health topics among patients and their caretakers. Lack of knowledge of TB and MDR TB etiology, symptoms, transmission route, and treatment procedure inhibits inner motivation from the patients to finish the treatment properly.[2] Along with that, misconceptions about the disease often result in negative social stigma. This may lead to individual treatment failure and continuous disease transmission within community, as it hinders contact investigations.[6]

Therefore, to overcome the risks that may arise from a lack of knowledge of MDR TB among patients and their caretaker, there is a need for education about the disease to raise awareness among them.[7] Education must be given to escalate patients' and their families' understanding of MDR TB to help strengthen control in treatment management and prevent the disease.[8] Positive reinforcement from their caretaker, especially family member, influences patients to complete the treatment.[9] Well-motivated patients, medical staffs, and families play a great role in nationwide TB control strategy, especially in determining treatment success.[10,11] Effective education methods should be considered as interventions; one of them is educational visual media.

Visual media is considered one of the most effective methods in the learning process to deliver ideas and information. The use of visual media has been widespread in medical education. It provides multichannel inputs, as visuals can increase memory over reading alone.[12] Visuals can capture more attention which leads to efficient learning. It also promotes feasible applications with complex concepts. [12] Not only is the fun factor, but it also offers brief and concise explanations of MDR TB that are easy to remember and practical. There have been few studies on MDR TB understanding levels among people in Bandung and method effectivity for MDR TB education.[13] This study is aimed to evaluate the implementation and effectiveness of visual graphic media as an educational intervention in improving patient and caretaker understanding of MDR TB in Bandung.

Methods

This cross-sectional designated study began with a pre-test for several groups: pre-treatment MDR TB patients, in-treatment MDR TB patients, and MTB patients' caretakers (family members). A pre-test questionnaire is distributed by the research nurse to assess initial knowledge from each participant, followed by educational sessions using visual media for a certain amount of time. To minimize the possibility of bias, the research nurse describes one topic before moving forward to the next. This also helps interpret the data with more objectivity and nuance. The educational compositions of the graphic visual media are divided into pages, listed in Table 1. At the end of the session, a post-test is conducted using the same question. The intervention is successful when the post-test score is better than the pre-test.

The study population is patients or their caretakers (family members) who visits TB MDR Clinic Dr. Hasan Sadikin General Hospital Bandung as a research site. Participants must be older than 17 years old and able to complete the questionnaire independently. There were 136 participants, 7 patients on treatment, 107 pre-treatment patients, and 22 caretakers/ family members. From 7 patients on treatment, 4 patients have been in <10 months, 2 patients have been in treatment for 12 and 14 months, and 1 patient has been in 20 months.

Along with personal sociodemographic data (age, sex, treatment status), basic MDR TB knowledge questions (MDR TB definition, causes, diagnostics, and treatment) also exist in the questionnaire as a Yes/No question. Each correct answer scores 1, and the false answer scores 0. Questionnaires are given twice as pre and post-test. Both scores will be compared in order to evaluate visual media effectiveness.

The research nurse gave a person-to-person educational session using visual media in the form of graphic-packed cards. This instrument was designed by researchers based on the MDR

Table 1 Educational Content through Visual Graphic Media

MDR TB Educational Content (Visual Graphic Media)		
Page 1	What is MDR TB	Explaining the etiology of MDR TB to clear the misunderstanding of common negative stigma
Page 2	What caused MDR TB	Explaining how MDR TB happens (e.g., not completing an entire course of TB treatment, relapse case, or getting infected from the person with MDR TB)
Page 3	How MDR TB is transmitted	Explaining that MDR TB is transmitted through air droplets, cutlery, close contact with person with MDR TB and that MDR TB is not transmitted through blood
Page 4	What are the symptoms of MDR TB	Explaining the symptoms of MDR TB, including continuous cough, fever, heavy breathing, sweating at night without significant physical activity, extreme weight loss, loss of appetite
Page 5	How MDR TB is diagnosed	Explaining laboratory diagnosis for MDR TB
Page 6	Prevention of MDR TB transmission	Reminding patients to wear masks anywhere to prevent transmission Explaining the importance of good infection prevention behavior and health attitude
Page 7	How MDR TB is treated	Explaining two types of treatment (short- and long-term regiments) Explaining the role of medication supervisor in treatment
Page 8	Discussion of common MDR TB drug side effects	Reminding patients to notify their health provider if any adverse symptom develops during the treatment Explaining not to stop the treatment despite of the side effects
Page 9	The importance of patient motivation	Reemphasizing the importance of completing the entire treatment course Reminding the importance of visiting the MDR TB clinic to take medication and regular examination

fact sheet of the Centers for Disease Control and Prevention (CDC) (accessed at https://www.cdc.gov/tb/publications/factsheets/drtb/mdrtb.htm? Sort=Title%3A %3Aasc) and divided to several study groups, such as "Aetiology", "Cause and Transmission", "Diagnostic", and "Treatment". Each card contains graphics and information according to a specific study group.

GraphPad Prism 8.3.0 are used to acquire answers data and their frequency and percentage. Pre and post-test significant statistical analysis will be analyzed using paired t-test method with a p-value <0.05 and a confidence interval of 95%. The education is considered successful if the score is more significant than the median.

Written informed consent is distributed to eligible patients. Personal data will not be exposed and will be kept anonymous. This study is part of community service work from a fundamental research grant from Universitas Padjadjaran for MDR TB with validated ethic code document number 636/UN6.KEP/EC/2018.

Results

All eligible participants who answered pre- and post-tests are grouped into pre-treatment, in-treatment, and caretaker (family member). Table 2 shows that most participants are male (72 persons. 52.9%). The age median is 41.90 years old, with higher distribution in productive age (36–45 years old). Most participants come from the pre-treatment group, with 107 participants (78.7%).

Pre and post-test, each consisting of 13 questions, are distributed to evaluate their understanding of MDR TB. There are several questions based on study groups: MDR etiology, causes and transmission, diagnostics, and treatment. The frequency and percentage of total participants' answers show in Table 3.

Table 2 Participant Sociodemographic Characteristics (n=136)

Characteristics	n	(%)
Age		
17–25	18	13.2
26–35	26	19.1
36–45	41	30.1
46–55	29	21.3
56–65	18	13.2
>65	4	2.9
Sex		
Male	72	52.9
Female	64	47.1
Category		
Pre-treatment	107	78.7
In treatment	7	5.1
Caretaker/family	22	16.2

Most participants already understand MDR TB presence, causes, transmission, and diagnostics. They learned that MDR TB is curable, but only 20,6% believe that MDR TB symptoms are equal to regular TB. Although, according to pre-test answers, the majority understand that mask must be worn (98.5%) during two years of treatment (59.6%) that rises various side effects (65.4%), half of participants don't know that medication must be done under direct supervision by medication supervisor (nurse or health worker). Correct answers, as the indicator of participant's knowledge, rises to 100% in almost every question after MDR TB educational session was given.

Increasing test scores are observed in almost all post-test questions in comparison to the pre-test. These changes are significantly observed in caretaker and pre-treatment groups (p-value=0.02 and 0,04, CI 95%, p<0.05) but not in the in-treatment group (p-value=0.39) as they may have got an explanation about MDR TB from a physician, nurse, or health worker in MDR TB clinic during the treatment (Table 4).

Discussion

Many patients diagnosed with MDR TB have limited knowledge and understanding about the disease.[14] This also happens to their caretaker, especially family members.[7] The abundance of confusion about the diagnosis raises social misperceptions and negative stigma to patients and their families, which might delay in seeking medical care and treatment.[15, 16] Therefore, MDR TB education is advised to be delivered to patients and caretakers to provide an understanding of the disease and the importance of its treatment. Clear information about the treatment process, including the advantages and treatment of side effects, hopefully, will clear the misinformation, increase caretaker's support and boost patient optimism to complete the treatment. The lack of understanding about MDR TB, including its symptoms, treatment management, and how it is transmitted, contributes to demotivation, wrong perception, and increasing anxiety, which leads to unsuccessful treatment.[6, 14]

One of the basic approaches to providing a sufficient fundamental understanding of MDR TB is face-to-face discussions between physicians, nurses, or health workers with patients and family members.[7] In this study, MDR TB education is given personally to patients and caretakers using visual media. This study implements educational graphic cards with attractive illustrations and clear and concise information about MDR TB. The graphic card includes sections on the etiology, cause and transmission, diagnosis, and treatment.

Pre and post-test were given, resulting in significantly increasing scores (t=3.249, df=3, p=0,04), interpreted as increasing subjects' knowledge of MDR TB. Overall, the education of MDR TB through visual graphic media resulted in noticeable observations and improved inpatient and caretaker understanding of the disease. This model could assist physicians, nurses, and health workers in decreasing the misconception about MDR TB and raising awareness and knowledge for patients and their caretakers to increase treatment success rates and provide better TB control in the future.

All 13 questions are grouped based on 4 study groups: etiology, causes and transmission, diagnosis, and treatment. All categories besides 'diagnoses consist of 4 questions.

In the pre-test, only 28 (20.6%) of all participants answered question No. 2 ("Does the symptoms of MDR TB are equal to regular TB?" – answered "Yes") correctly. Possibly, most people think that there are visible symptoms that distinguish MDR TB from regular TB, whereas the differences can only be known through GeneXpert MTB/RIF examination and phenotypic DST (Drug Susceptibility Test). After

Table 3 Participant's Knowledge on MDR TB

Topics (Questions)	Correct Answer (n=136)				p-value (CI 95%)
	Pre-test		Post-test		
	n	(%)	n	(%)	
Aetiology					
MDR TB is equal to regular TB (No)	86	63.2	125	91.9	
The symptoms of MDR TB are equal to regular TB (Yes)	28	20.6	85	62.5	
TB release is possible (Yes)	105	77.2	133	97.8	
MDR TB can be cured (Yes)	129	94.9	135	99.3	
Causes/transmission					
MDR TB are caused by resistant mycobacteria (yes)	97	71.3	136	100	
MDR TB are caused by unfinished treatment (yes)	104	76.5	136	100	
MDR TB are caused by irregular drug consumption (yes)	102	75.0	136	100	
MDR TB can be spread to another patient (yes)	109	80.1	136	100	t (3.429). df (3). p-value 0.04
Diagnostics					
TB Diagnostics uses sputum as sample (yes)	117	86.0	136	100	
Treatment					
MDR TB Patients should wear mask to avoid transmission (yes)	134	98.5	136	100	
MDR TB treatment must be finished in 2 years (yes)	81	59.6	134	98.5	
MDR TB treatments side effects are nausea, vomiting, headache, diarrhea, malaise (yes)	89	65.4	136	100	
Everyday drug consumption must be under direct supervision by medication supervisor (yes)	55	40.4	127	93.4	

Table 4 Questionnaire Scores Based on Study Groups

Topic	Caretaker/ Family (n=22)				Pre-treatment patient (n=107)				In-treatment patient (n=7)			
	(Max. total score=286)				(Max. total score=1,391)				(Max. total score=91)			
	Pre-test		Post-test		Pre-test		Post-test		Pre-test		Post-test	
	Score	(%)	Score	(%)	Score	(%)	Score	(%)	Score	(%)	Score	(%)
Aetiology	55	62	77	88	270	63	375	88	23	82	26	93
Causes/ Transmission	68	77	88	100	316	74	428	100	28	100	28	100
Diagnosis	15	68	22	100	95	89	107	100	7	100	7	100
Treatment	54	61	86	98	277	65	419	98	28	100	28	100
Total Score	192	67	273	96	958	69	1,329	96	86	95	89	98
p-value (CI 95%)	t (3.941), df (3), p-value (0.02)				t (3.302), df (3), p-value (0.04)				t (1), df (3), p-value (0.39)			

the educational session, 85 (62.5%) subjects answer this question correctly. In the pre-test, most participants acknowledge that although there may be relapse (n=105, 77.2%), MDR TB is still curable (n=129, 94.9%). At these questions, 20.6% dan 5% score increments are observed in the *post-test.*

From pre-test answers, most people understand that MDR TB is caused by resistant TB mycobacteria (n=97, 71.3%) that rises after incomplete treatment (n=104, 76.5%), irregular treatment (n=102, 75%) or infection from another patient (n=109, 80.1%). All questions are answered correctly by all participants after the educational session. This study shows that visual educational media are impactful in increasing MDR TB knowledge (t= 13.29, df=3, p=<0.001). Better knowledge drives patients and their caretakers' motivation to complete the treatment.

Although GeneXpert MTB/RIF was used for MDR TB primary detection when this study was conducted, it is considered that patients and caretakers need to become more familiar with the name of the diagnostic test. Therefore, 'sampling material' is considered the only question in this section. Most participants know sputum as diagnostic material (n=117, 86%). Complementing this knowledge, information on correct sputum collection procedures, definitive diagnosis, and follow-up procedures are also informed in this educational session, raising participants' understanding to 100%.

Almost all participants know that masks must be worn during two years of treatment (pre-test n=134, 98.5%; post-test 100%), but only a few realize that drug consumption must be done under direct medication supervision (nurse or health worker) (n=55, 40.4%). This is a very important thing to remember to avoid patients' unattended and irregular drug consumption that might cause serious side effects such as nausea, vomiting, or tinnitus.[14]

After this educational intervention using graphic visual media, it is rewarding that the participants attained a high knowledge score (around 90%) in all group variables. The in-treatment patient group achieves the highest collective score, as they were currently doing the treatment. They likely acquired TB education during the treatment.[6] Higher significance of knowledge elevation, after educated using visual media, makes this method becomes more effective for families and pre-treatment patients (Caretaker/family: t (3,941), df (3), p-value (0.02); Pre-Treatment Patients Group: t (3.302), df (3), p-value (0.04)).

Few in-treatment patients come to the clinic due to limited transportation costs, tiredness of side effects, or not knowing that treatment should be supervised by a medication supervisor (usually a nurse or health worker). This resulted in the ratio balance of the number of participants in each group, which became our study limitation. Furthermore, there are few conducted studies on methods and learning media about TB and MDR TB knowledge for patients. This study needs more references and further research in the future.

This study reflects the need for education on MDR TB to raise awareness among patients and caretakers, as knowledge about MDR TB is crucial for patients and caretakers to support successful treatment. Therefore simple graphic visual media can be used to deliver education. Based on this study, this finding suggests that simple but effective graphic visual media resulted in satisfying improvement in all aspects of knowledge of MDR TB within the participants when implemented in the MDR TB clinic. This can provide an efficient and effective strategy for increasing patient and caretaker understanding of MDR TB. For further studies, there should be a comparison between this kind of visual media and another learning process and platform for further evaluation. Therefore, the most suitable method can be implemented to increase treatment success and obtain a better national TB control strategy.

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