

A Quasi-experimental of a Virtual Reality Content Intervention for Level of Comfort of Indonesian Cancer Patients

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This study aims to determine the effect of virtual reality content on the comfort level of cancer patients. This study used a quasi-experimental non-equivalent control group design and was conducted on 60 cancer patients. The intervention uses the virtual reality content "My Comfortable Environment," which was developed based on Kolcaba's comfort theory. Comfort level was measured using the Shortened General Comfort Questionnaire. The Wilcoxon and Mann-Whitney *U* tests were used to determine the differences before and after the intervention within the group and between the study groups. There was a significant mean difference between pre-test and post-test in the intervention group with $P < .000$, $Z = -4.785$, and in the control group with $P < .041$, $Z = -2.032$. These results indicate that interventions with virtual reality content and guided imagery both affect the comfort level of cancer patients. However, if the test was conducted between groups, there was a significant difference between the intervention group and the control group with a *P* value of $< .000$. These results indicate that the virtual reality content intervention can significantly increase the level of patient comfort through modifying various aspects of patient comfort, especially environmental aspects.

KEY WORDS: Cancer, Comfort level, Nursing care, Virtual reality

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This review was funded by Lembaga Pengelola Pendidikan (Indonesia Endowment Fund for Education), grant number 20161141041627.

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

Author Contributions: A.W.J.: conceptualization, methodology, investigation, formal analysis, data curation, writing – original draft. T.N.K.: methodology, validation, writing – reviewing and editing, supervision. U.S.: methodology, validation, visualization, writing-reviewing and editing, supervision. Y.W.P.: investigation, writing – reviewing and editing, supervision. L.D.: writing – reviewing and editing. A.P.W.: software, validation.

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DOI: 10.1097/CIN.0000000000000953

According to GLOBOCAN data in 2020, the number of new cancer cases in Indonesia reached 396914 people with a mortality rate of 234511 people.¹ Indonesia is a developing country where most cancer patients are terminally ill and experience emotional challenges and physical pain, including discomfort.² For example, for breast cancer, 60%-70% of patients are in stages III-IV (advanced stage).³ The high number of patients with advanced cancer in Indonesia is related to the region's culture and values. Indonesian people choose to try to treat the condition themselves by using traditional therapy. They do not visit healthcare facilities unless that treatment or alternative therapy fails, so the cancer diagnosis is not made until the cancer is already in an advanced stage.⁴

Discomfort is an unpleasant feeling or sensation felt by an individual with a natural response of avoiding or reducing the source of unpleasant feeling through verbal or non-verbal self-reporting.⁵ The most frequent discomfort reported by cancer patients are pain (72.9%), sleep disturbances (71.7%), functional disability (62.1%), and anxiety and depression (54.4%).⁶ Even though pain can cause discomfort, not all discomfort is associated with pain. Breast cancer patients often experience discomfort, both physically and psychologically; however, health workers have limited capacity to help them.² Comfort is an important component of nursing in palliative care.

Discomfort that is not well managed will have a negative impact on patients' quality of life. The discomfort felt by cancer patients is the most disturbing aspect and has a major impact on their quality of life; it has been reported that 82.3% of patients have a low quality of life.⁶ Low quality of life is associated with poor adherence to rehabilitation programs,⁷ low survival rate,⁸ and an increased risk of suicide in cancer patients.⁹

Nurses are health professionals who intensively interact with patients and their families, which includes listening to cancer patients with complaints of discomfort. The nurse's role is very important in managing discomfort, implementing actions that optimize comfort level by using non-pharmacological therapy, and evaluating their implementation.¹⁰ Previous studies reported that by synchronizing pharmacological and non-pharmacological therapies, the

discomfort could be optimally reduced by reducing the side effects of the given pharmacological therapy.¹¹

One of the non-pharmacological therapies used to reduce discomfort is distraction. Until now, the challenge in applying distraction techniques has been in modifying the patient care environment, with nurses still using conventional distraction techniques, including that of guided imagery. This is a technique by which nurses direct patients to imagine the things they like the most, thereby deriving comfort from it. Optimization of distraction techniques needs to be done by creating comfortable conditions from various aspects.¹² Optimal comfort conditions for individuals will make it easier to maintain consistency in every activity, including dealing with various problems encountered during treatment and behavior in improving their health.¹³ Distraction techniques that can stimulate and involve multiple senses concurrently are considered to be more effective.¹⁴

Virtual reality (VR) is a product of technological developments that allow users to be actively involved in the content viewed and to change the environment as expected.¹⁵ The technique can also modify and create immersive, multisensory (virtual, auditory, tactile, and olfactory), and three-dimensional environments. The technology is actively involved in the process of emotional regulation and individual attention, including modulating pain systems in the body.¹⁶ Quality, relevant, and immersive content is the most critical aspect of using VR to achieve the intervention objectives. However, the use of VR for non-pharmacological therapies has been considered as new with few research that have been conducted, especially in the study of the comfort level of cancer patients from VR content, in order to know the effectiveness of VR for treating the cancer patients. The research question in this study is “Is there an increase in comfort level after VR content intervention in cancer patients?”

METHODS

Design and Setting

This study used a quasi-experimental non-equivalent control group design, conducted over a 3-month period (December 2020 to February 2021) at a referral hospital in Indonesia. The ethical clearance number was 530/EC/KEPK-RSDK/2020, which has been approved by the institutional review board from the referred hospital. This ethical clearance was based on seven standard values from the World Health Organization, namely, (1) social values, (2) scientific values, (3) equitable assessment and benefits, (4) risks, (5) persuasion/exploitation, (6) confidentiality and privacy, and (7) informed consent, referring to the 2016 The Council of International Organizations of Medical Sciences Guidelines.^{17,18}

The quasi-experimental non-equivalent control group design started with a normality and homogeneity test to get the data distribution. The result showed that the distribution was not normal. Therefore, a non-parametric test

was conducted to study the difference between the groups. In order to minimize unbalanced data, the variance control by controlling the confounding variable and inclusion and exclusion criteria have been taken into consideration.¹⁹

Participants

The recruitment process has been done by the enumerator who has been qualified by the researcher. The recruitment started with screening the cancer patients, which was limited to the inpatient status based on the inclusion and exclusion criteria applied. The selected patients were then divided into control and intervention groups based on the research aims. The study used a minimum sample size for experimental research,²⁰ Sixty patients who participated in this study were divided into two groups of 30 patients each in the intervention and control groups, by using consecutive sampling. The inclusion criteria were as follows: (1) being a cancer patient aged 18-60 years; (2) suffering from cancer for more than 6 months and having cancer stages II-IV; and (3) being able to read and write. To optimize VR use and ensure its effectiveness, the respondents involved had no head or neck injuries; no history of motion sickness; no experience of nausea and dizziness; and no cognitive impairment, hearing, or visual problems.²¹⁻²³

Interventions

The intervention group received VR content, namely, “My Comfortable Environment,” based on Kolcaba’s comfort theory, which focuses on efforts to increase the level of individual comfort. “My Comfortable Environment” is a VR content with rural natural scenery, educational media through television, music therapy via radio, and various light activities, such as archery and tidying the dining table, that users participate in, as described in Figure 1.

Researchers carried out the intervention on patients in their own room inclusively by using VR with “My Comfortable Environment” content for 30 minutes. During the intervention, the content was selected and optimized by the patients themselves after getting a demonstration and guidance by the researcher earlier. The reason was to make the patients comfort and free as they felt that were living in real world while watching the scene on VR. The researcher did a casting to find out what they observed when using VR. This casting means that the researcher can monitor and observe the patient activity during the intervention directly. Then, the researcher examined the comfort level of the subjects for 15 minutes after the intervention as a post-test and recorded the data. If any side effects appeared (dizziness and nausea), the intervention was stopped and immediately reported to the doctor in charge. The intervention was conducted in the patient’s room, and safety and conducive environmental conditions were considered, with sufficient privacy provided.



Television and Radio on Scene



Natural view from inside the house

FIGURE 1. Screenshot of VR content “My Comfortable Environment.”

While the control group received guided imagery intervention, nurses provided direction to patients in generating and producing visual, auditory, haptic, taste, and smell experiences that trigger behavioral and physiological responses. Guided imagery is a technique that uses imagination and visualization to help reduce stress and promote relaxation.²⁴

Outcomes

The study began with all respondents filling in demographic data and comfort level as a pre-test, while wearing personal protective equipment (mask and eye masks). The primary outcome that we measured was the level of comfort in cancer patients after being given a VR content intervention. This study did not have a secondary outcome. Comfort level

was measured using the Shortened General Comfort Questionnaire, which was filled by the patients under the supervision of the enumerator during the pre-test and post-test. This instrument provides an overview of the individual's level of comfort in accordance with their condition, by using a 28-item Likert scale. The Likert scale ranges from 1 (strongly disagree) to 6 (strongly agree). Higher scores indicate greater comfort. The maximum possible score was 168 points, and the minimum possible score was 28 points.²⁵ This instrument has a validity and reliability value of Cronbach's α of 0.769.

Statistic Data Analysis

The Wilcoxon test was used to determine the differences in the average comfort level within the groups. In contrast, the Mann-Whitney test was used to determine the difference in the average comfort level between the groups. All data analysis was performed using IBM SPSS Statistics for Windows version 23 (IBM Inc, Armonk, NY, USA).

RESULTS

More than half of the respondents were women, had a high school education, were employed, were diagnosed with rectal

cancer, and had stage III cancer. There were no significant differences in the characteristics of sex, education, employment status, age, type, and stage of cancer between the two study groups (Table 1).

The results showed a significant difference in outcomes for the two studied groups. These showed the comfort level within the intervention group before and after the intervention resulted in a P value of .000. Under guided imagery, there is also a significant difference in the level of comfort in the control group with a P value of .042 (Table 2).

To determine the effectiveness of VR content, compared with guided imagery, the Mann-Whitney test was conducted. The results showed that the level of comfort between the intervention and control groups has a P value of .000 (Table 3), which indicates a significant difference in comfort level between respondents who received the VR content "My Comfortable Environment" compared with guided imagery.

DISCUSSION

This study found that VR, using the content of "My Comfortable Environment," significantly increased the comfort level of cancer patients. Comfort is a pleasant sensation experienced by individuals and includes the physical, psychospiritual, social,

Table 1. Respondent's Characteristics

Respondent's Characteristics	Category	Intervention Group		Control Group		Test	P
		n	%	n	%		
Sex	Men	10	33.3	9	30	χ^2	.781
	Women	20	66.7	21	70		
Education	Elementary	11	36.7	12	40	χ^2	.676
	High school	16	53.3	14	46.7		
	University	3	10	4	13.3		
Employment status	Not employed	11	36.7	13	43.3	χ^2	.598
	Employed	19	63.3	17	56.7		
Age	<Mean (48.1 y)	10	33.3	16	53.3	χ^2	.118
	≥Mean (48.1 y)	20	66.7	14	46.7		
Type of cancer	Ca nasopharynx	2	6.7	3	10	χ^2	.417
	Ca colon	3	10	7	23.3		
	Ca rectum	15	50	10	33.3		
	Ca cervix	2	6.7	5	16.7		
	Ca mammae	4	13.3	1	3.3		
	Ca ovarium	1	3.3	2	6.7		
	Ca lung	1	3.3	1	3.3		
	ALL	1	3.3	0	0		
	LMNH	1	3.3	0	0		
	Ca corpus uteri	0	0	1	3.3		
Stages	III	24	80.0	17	56.7	χ^2	.051
	IIIB	3	10.0	11	36.7		
	IIIC	3	10.0	1	3.3		
	IV	0	0	1	3.3		

Abbreviations: ALL, Acute Lymphocytic Leukemia; Ca, Cancer; LMNH, Lymphoma Malignant Non-Hodgkin.

Table 2. The Difference Between Level of Comfort Before and After Intervention (Within the Group)

Group	Before	After	Δ	Z	P
	Mean (Min-Max)	Mean (Min-Max)			
Intervention	104.333 (70–125)	124.20 (90–142)	19.867	–4.785	.000
Control	106.967 (74–128)	107.57 (74–129)	0.603	–2.032	.042

Abbreviations: Max, maximum; Min, minimum.

Tested by Wilcoxon test.

and environmental aspects of a direct and comprehensive intervention.²⁶ Virtual reality interventions are more effective when compared with imagination techniques, and depth (the level of affecting sight sense)^{27,28} and interaction with content can increase user attention and understanding so that they are positively correlated with specific emotional and health behaviors.¹⁵ Virtual reality is an effective distraction method to reduce the individual's level of discomfort by conditioning the pain modulation process with an endogenous factor inhibition mechanism.²⁹ Optimal comfort will make it easier for individuals to deal with problems during their treatment and is a trigger for positive behavioral changes, which improves their health.¹³

Virtual reality implementation among patients with discomfort depends on the quality, relevance, and depth of VR content in focusing on the patient's attention while using it. This mechanism occurs by reducing activity in the anterior cingulate cortex, primary and secondary somatosensory cortex, insula, and thalamus.³⁰ Diverting attention to something more enjoyable and making the patient comfortable is the best key in optimizing distraction techniques in patients with discomfort.³¹

Virtual reality allows users to absorb scene content and actively participate. The VR headset usually contains display or content positioned right in front of the user's eyes and set on the user's head.³² The purpose of the headset is to restrict the human field of vision to the atmosphere seen in the VR, so that the user is completely absorbed in it and sees nothing beyond it, thereby transferring them to another world and abandoning the real world. This sophisticated VR technology is used to make modifications related to comfort, including the environment, through content viewed by users. Thus, by wearing a VR headset, the user will focus more on what is being seen and abandon other stimuli that are not beneficial, including discomfort. According to Bani Mohammad and Ahmad,²³ the user, when viewing VR content, focuses more on what is being viewed and this triggers a pleasant feeling. This finding supports previous research that VR interventions are often utilized during painful procedures and reduce individual discomfort.³³

“My Comfortable Environment” is a VR content that provides a subtle sensation of natural scenery and rural environments. A comfortable environment has a natural scenery background that includes temperature, light, sound, color, furniture, and a vast expanse.³⁴ Ulrich and Giplin³⁵ stated that the images with the nuances of natural scenery could reduce discomfort including stress and pain.³⁶ Visual stimulation also functions as a distraction to reduce discomfort, including unbearable pain.³⁷ Research shows that post-operative individuals treated in natural-scenery rooms have a shorter length of stay and require lower analgesic doses than patients treated in the therapy room with curtain or walls.³⁸

According to Verderber,³⁹ hospitalized patients prefer to be treated in a windowed room because they can see plants and the environment outside the room. In contrast, patients dislike windowless rooms during treatment. Beauchemin and Hays,^{40,41} in their research, found that patients have a shorter length of hospital stay if they are treated in rooms with adequate (bright) lighting rather than in dark rooms. Patients treated in rooms with adequate lighting had an average stay of 16.6 days, whereas those in rooms with dim light stayed for 19.5 days. Nature is beneficial in improving cognitive function,⁴² immune function,⁴³ behavior in response toward stress,⁴⁴ and physiological matters.⁴⁵ Furthermore, nature has a beneficial effect by reducing stress responses.⁴⁵ This is supported by many studies showing that groups given environmental enrichment have lower cortisol levels.^{46–48}

The study of mental recovery⁴⁹ and stress reduction⁵⁰ through natural environment interventions has recently become an exciting topic of discussion in the health field. The role of nature in cancer patients attracts attention to identify

Table 3. The Comparison of Comfort Level Between the Intervention and Control Groups

Group	Before		After		P
	Mean	SD	Mean	SD	
Intervention	104.333	15.4815	124.20	14.556	.000
Control	106.967	15.2936	107.57	15.706	

Tested by Mann-Whitney test.

forms of psychosocial care that encourage patients to cope with their discomfort.⁵¹ Findings from clinical population studies suggest a positive relationship between exposure to a natural environment. They decreased physical discomfort during surgical procedures,^{38,52} decreased length of hospital stay, reduced dependence on analgesics,³⁸ increased psychological well-being,³⁶ and increased positive affect and mood.⁵³ Some studies showed that using a natural environment in healthcare settings may increase patients' satisfaction with their care as well.⁵⁴ Previous research on cancer patients showed that nature-based interventions could improve quality of life,⁴⁵ promote positive health behavior such as physical exercise, restore attention,⁵⁵ and promote their social interactions.⁵⁶

Some obstacles while conducting an intervention were that the respondent needed time to adapt to the sophistication of VR technology for the first time, meaning that the researcher introduced the subjects to VR before the study commenced. In addition, data collection was carried out during pandemic conditions following strict health protocols to minimize the potential for transmission of COVID-19.

Limitations

Nurses can use the content of VR “My Comfortable Environment” as one of their measures to modify the environment and use it as a distractive instrument to increase comfort. However, this research has some limitations that should be addressed in future research, such as (1) there is a need to conduct a qualitative study that supports the in-depth examination of patients' experiences related to comfort during VR sessions, and (2) this research was only conducted in one location. Therefore, there is a need for other research to be conducted in other areas to generalize the content of “My Comfortable Environment.”

CONCLUSION

The VR instrument with “My Comfortable Environment” content has been proven to significantly increase comfort in cancer patients. This benefit provides additional options for nurses to provide non-pharmacological interventions to patients experiencing discomfort. The sophistication of VR instruments enables nurses to modify various aspects of comfort for individuals. The content of VR in this study is a non-pharmacological intervention that is safe and comfortable, without side effects.

Acknowledgment

The authors thank the reviewers for their insightful comments and efforts that helped clarify this manuscript and the Lembaga Pengelola Dana Pendidikan from the Ministry of Finance Indonesia, for funding this research.

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