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The Effectiveness Of Virtual Reality Distraction On Reducing Pain Levels And Fear In Children During Injection Procedures At Rsij Cempaka Putih

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Abstract

Injection procedures are a primary source of pain and fear in children that can lead to psychological trauma and hinder compliance with future medical care. This study aimed to evaluate the effectiveness of virtual reality distraction techniques in reducing pain and fear levels in children during injection procedures at Jakarta Islamic Hospital Cempaka Putih. The study employed a quasi-experimental design with a one group pretest-posttest approach involving 36 child respondents aged 3-12 years undergoing repeated injection procedures. Pain measurement used the Wong-Baker FACES Pain Rating Scale and fear used the Children's Fear Scale, with data analysis using the Wilcoxon Signed Rank Test. Results showed significant reductions in pain and fear levels after virtual reality intervention, with significance values of 0.000 for all variables. Children's assessment showed no pain increased from 16.7% to 52.8%, while no fear increased from 2.8% to 72.2%. Researcher assessments also showed consistent reduction patterns. This study concludes that virtual reality is effective as a non-pharmacological intervention to reduce pain and fear in children during injection procedures, thus can be integrated into pediatric pain management protocols in healthcare facilities.

Keywords: Virtual Reality, Pediatric Pain, Fear, Injection Procedure, Non-Pharmacological Distraction.

INTRODUCTION

Injections are an integral part of pediatric healthcare, whether for immunization, blood sampling, or medication administration. Although routine, injections remain a major source of pain and fear in children. Acute pain experienced during medical procedures can lead to psychological trauma, a tendency to refuse future care, and even impact mental health and long-term compliance with immunization programs. Furthermore, children's fearful reactions often complicate procedures and increase parental anxiety and the workload of healthcare workers. (Sánchez- et al., 2025).

Data from the World Health Organization (WHO) shows that procedural pain in children is still often neglected, especially in developing countries. The WHO estimates that more than 60% of pediatric invasive procedures in healthcare facilities are not accompanied by adequate pain management, either pharmacological or non-pharmacological. This condition leads to increased anxiety and psychological trauma in children, as well as a decline in the overall quality of healthcare services. (Sánchez- et al., 2025). Studies in European pediatric hospitals have shown that approximately 83% of preschool-aged children exhibit excessive fear during blood draws, yet only about 10% of them receive structured distraction interventions. This imbalance between procedure frequency and readiness for pain management is a critical issue in modern pediatric nursing practice.

The high prevalence of pain and fear in children during injections has prompted various innovations in procedural pain management. One rapidly growing approach is the use of technology-based distraction techniques such as virtual reality (VR). VR technology offers sensory experiences and immersive environments that can optimally divert a child's focus. Several global studies have demonstrated that VR significantly reduces the perception of pain and fear during injections or vaccinations. A large-scale randomized study showed that children who received VR intervention experienced a 28-point reduction in pain scores compared to the control group, and the proportion of children reporting no pain nearly tripled. (Ali et al., 2021). A recent meta-analysis also demonstrated the effectiveness of VR in various invasive procedures in children, with a reduction in pain scores of

up to 0.47 points on a 0-10 scale, with consistent results across various clinical settings and pediatric populations.

In Asia, research is emerging on the effectiveness of technology-based interventions in addressing pain and anxiety in children. A *randomized controlled trial* (RCT) in South Korea involving children aged 4-10 years showed that the use of virtual reality (VR) before and during venipuncture significantly reduced pain and fear scores reported by both children and observed by nurses. The mechanism of VR is believed to be related to pain distraction and deeper cognitive and sensory engagement, where children not only watch but also become fully emotionally involved in a safe and enjoyable virtual world. (Fern et al., 2020).

However, in Indonesia, the use of technologies like VR or other interactive media as distraction methods is still very limited. Common practices include educational videos on tablets or television, traditional games, music, or toys. While these interventions have benefits, their effectiveness has not yet matched that of immersive technology-based interventions like VR. (Dumoulin et al., 2019). A preliminary survey at Cempaka Putih Islamic Hospital in Jakarta showed that the hospital had not yet adopted VR as a non-pharmacological management tool to help reduce pain and fear in children undergoing invasive procedures. This gap is even more pronounced in Southeast Asia, where cultural factors and access to technology may influence children's responses but have not been specifically studied.

Previous research has tended to focus on a single aspect or study population in Western countries, so the results may not be applicable to the Southeast Asian context, where differences in medical, social, and technological access are likely to exist. By measuring pain and fear using standardized measurement tools such as the *Wong-Baker FACES* and the *Children's Fear Scale*, this study aims to address the limitations of the existing literature and generate evidence-based recommendations that can be widely applied in pediatric nursing practice in Southeast Asia. This study aims to determine the effectiveness of virtual reality distraction techniques in reducing pain and fear levels in children during injection procedures, identify the characteristics of respondents, and identify pain and fear levels in children before and after being given VR intervention during injection procedures.

RESEARCH METHODS

This study used a quasi-experimental design with a one-group pretest-posttest approach to evaluate the effectiveness of distraction techniques using virtual reality (VR) on reducing pain and fear levels in school-aged children during injection procedures. Measurements were taken at the first injection as a pretest (before the intervention) and the second injection as a posttest (after the intervention).

The research was conducted at the Jakarta Islamic Hospital Cempaka Putih from September to December 2025, covering the preparation, implementation, and preparation stages of the research results report.

The study population was children aged 3-12 years who underwent repeated injection procedures at the Jakarta Islamic Hospital, Cempaka Putih. The sampling technique used purposive sampling with an accidental sampling approach. The sample size was determined using the paired t-test formula, resulting in 36 respondents.

Pain was measured using the Wong-Baker FACES Pain Rating Scale (WBFPRS) with six facial images (scored 0-10). Fear was measured using the Children's Fear Scale (CFS) with five facial images (scored 0-4). Both instruments have been internationally validated for their validity and reliability. An observation sheet was used to record children's involvement in VR use, while an identity sheet recorded respondents' demographic data.

The preparation phase includes obtaining permits, ethical approval, and coordination with medical personnel. The implementation phase begins with an explanation of the research and informed consent, followed by a pretest measurement for the first injection without intervention, VR intervention for the second injection, and a posttest measurement. The data processing phase includes editing, coding, processing, and cleaning using statistical software. The research adheres to ethical principles by applying the principles of informed consent, anonymity, confidentiality, and beneficence and non-maleficence.

Data analysis was performed univariately and bivariately. Data analysis aims to answer the problem formulation and test the hypothesis. Univariate analysis describes the characteristics of respondents through frequency distribution, percentage, mean, median, and standard deviation. The use of WBFPRS and CFS in pediatric populations. Bivariate analysis uses paired t-test for normally distributed data or Wilcoxon signed-rank test for non-normal data, with a significance level of $\alpha = 0.05$, where a p-value <0.05 indicates a significant difference in reducing pain and fear levels.

RESULTS AND DISCUSSION

Respondent Characteristics

This study involved 36 child respondents who underwent injection procedures at RSIJ Cempaka Putih, with all data collected completely without missing values. The characteristics of the respondents showed a predominance of 6-7 years old, with 16 children or 44.4% of the total sample, followed by 10 years old at 19.4%. The gender distribution showed 24 boys (66.7%) and 12 girls (33.3%). The history of complaints was dominated by fever at 63.9%, followed by dengue fever at 8.3%, and other complaints at 2.8% each.

Table 1. Respondent Characteristics Based on Age and Gender

Category	Frequency	Percentage (%)
Age		
6 year	8	22,2
7 year	8	22,2
10 year	7	19,4
12 year	3	8,3
8 year	3	8,3
Other Age	7	19,4
Gender		
Boys	24	66,7
Girls	12	33,3

Pain and Fear Levels After Intervention (*Pre-Test*)

The results of the pre-test measurements showed that the level of pain based on the children's assessment was categorized as hurts little more (score 4) at 52.8%, hurts even more (score 6) at 19.4%, hurts whole lot (score 8) at 11.1%, and no pain (score 0) at 16.7%. The researchers' assessments showed a similar pattern with hurts little more at 52.8%, somewhat hurts even more at 36.1%, hurts little bit at 8.3%, and hurts worst at 2.8%.

Table 2. Distribution of *Pre-Test* Pain and Fear Levels

Category	Child Assessment	Researcher Assessment
	f (%)	**f (%)**
Pain Pre-Test		
Hurts Whole Lot (Score 8)	4 (11,1)	-
Hurts Even More (Score 6)	7 (19,4)	13 (36,1)
Hurts Little More (Score 4)	19 (52,8)	19 (52,8)
Hurts Little Bit (Score 2)	-	3 (8,3)
Hurts Worst (Score 10)	-	1 (2,8)
No Hurt (Score 0)	6 (16,7)	-
Fear Pre-Test		
Most Scared (Score 4)	1 (2,8)	1 (2,8)
Scared Bit More (Score 2)	14 (38,9)	8 (22,2)
Scared Little Bit (Score 1)	20 (55,6)	21 (58,3)
Not Scared (Score 0)	1 (2,8)	6 (16,7)

In terms of fear, children's assessments showed a scared little bit (score 1) of 55.6%, scared bit more (score 2) of 38.9%, most scared (score 4) of 2.8%, and not scared (score 0) of 2.8%. The researcher's assessment showed a scared little bit of 58.3%, scared bit more of 22.2%, not scared of 16.7%, and most scared of 2.8%.

Pain and Fear Levels After Intervention *(Post-Test)*

After the virtual reality intervention, post-test results showed significant changes. Pain levels based on children's assessments showed no hurt (score 0) in 52.8%, hurts little bit (score 2) in 33.3%, and hurts little more (score 4) in 13.9%. The researchers' assessments showed hurts little bit in 66.7%, hurts little more in 22.2%, and no hurt in 11.1%.

Table 3. Distribusi Tingkat Nyeri dan Ketakutan *Post-Test*

Category	Child Assessment	Researcher Assessment
	f (%)	**f (%)**
Nyeri Post-Test		
Hurts Little More (Score 4)	5 (13,9)	8 (22,2)
Hurts Little Bit (Score 2)	12 (33,3)	24 (66,7)
No Hurt (Score 0)	19 (52,8)	4 (11,1)
Ketakutan Post-Test		
Scared Bit More (Score 2)	1 (2,8)	1 (2,8)
Scared Little More (Score 1)	9 (25,0)	2 (5,6)
Not scared (Score 0)	26 (72,2)	33 (91,7)

In terms of fear, children's assessments showed a not scared (Score 0) of 72,2%, scared little more (Score 1) of 25,0%, and scared bit more (Score 2) of 2,8%. The researchers' assessments showed not scared 91,7%, scared little more 5,6%, and scared bit more of 2,8%.

Normality Test and Bivariate Analysis

The normality test using Shapiro-Wilk showed that all variables had a significance value of $p < 0.05$, so the data was not normally distributed and the analysis used the Wilcoxon Signed Rank Test.

Table 4. *Shapiro-Wilk* Normality Test Results

Variable	Statistic	df	Sig.
Child Pain Pre-Test Score	0,843	36	0,000
Researcher Pain Pre-Test Score	0,793	36	0,000
Child Fear Pre-Test Score	0,767	36	0,000
Researcher Fear Pre-Test Score	0,789	36	0,000
Child Pain Post-Test Score	0,746	36	0,000
Researcher Pain Post-Test Score	0,743	36	0,000
Child Fear Post-Test Score	0,601	36	0,000
Researcher Fear Post-Test Score	0,313	36	0,000

Table 5. *Wilcoxon Signed Rank Test Results*

Variable	Nilai Z	*Asymp. Sig. (2-tailed)*
Pain (Child)	-5,436	0,000
Pain (Researcher)	-5,385	0,000
Fear (Child)	-5,340	0,000
Fear (Researcher)	-4,944	0,000

The results of the Wilcoxon Signed Rank Test showed a significant decrease in all variables with a Z value for child pain of -5.436, researcher pain -5.385, child fear -5.340, and researcher fear -4.944, with *an asymp. sig*. (2-tailed) of 0.000. These results indicate that the Virtual Reality intervention effectively reduced the level of pain and fear in children based on both assessment perspectives.

Respondent Characteristics and Pre-Intervention Conditions

The respondents, predominantly aged 6-7, are in the early school phase, where children's cognitive abilities are sufficiently developed to understand their surroundings, but their emotional regulation and pain tolerance are still limited. Piaget's theory of cognitive development explains that school-age children are in the concrete operational stage, enabling them to understand cause and effect, including associating injection needles with previously experienced pain. Acute illness can increase a child's sensitivity to pain stimuli because the body is under physiological stress, making the injection procedure more painful and frightening. (Gold, Mahrer, et al., 2021). Gender differences in this study indicated a male predominance, with boys tending to express pain more explicitly through behavioral responses, while girls expressed fear more emotionally. The pre-test pain level findings are consistent with previous research. (Jenabi et al., 2023) who reported that the injection procedure almost always causes moderate pain in children if not accompanied by adequate distraction techniques.

Effectiveness of Virtual Reality in Reducing Pain and Fear

The significant reduction in pain and fear levels after the Virtual Reality intervention indicates that this method is effective as a non-pharmacological distraction in children during injection procedures. This finding is consistent with a meta-analysis. (Lee, 2024) which reported that Virtual Reality significantly reduced pain and anxiety in children during needle procedures. Studies (Sahin et al., 2025) also found that children who used virtual reality experienced less pain and were more cooperative during IV line insertion. A study (Sayed et al., 2020) supports these findings by showing that virtual reality effectively reduces fear and increases comfort during immunization.

Mechanistically, Virtual Reality works through attention distraction and dominant sensory stimulation, so that the child's cognitive activity is focused on the virtual environment and not on pain stimuli, in accordance with the pain gate theory *(gate control theory).* (Vitor et al., 2025) showed that immersive distractions such as Virtual Reality have a stronger analgesic effect than passive distractions due to deeper cognitive and emotional engagement. Study (Tan et al., 2023) showed that

children who get Virtual Reality distraction during the procedure venipuncture menemukan bahwa anak yang mendapatkan distraksi *Virtual Reality* selama prosedur *venipuncture* experienced a more significant reduction in pain and distress compared to the video tablet.

Lower post-intervention fear scores were associated with increased feelings of control and safety in children during medical procedures, which positively impacted the overall care experience (La et al., 2025). Cognitive distraction theory explains that distraction can reduce children's perceived threat and emotional responses to invasive procedures. A meta-analysis by (La et al., 2025). Cognitive distraction theory explains that distraction can reduce children's perceived threat and emotional responses to invasive procedures. A meta-analysis by (Sánchez- et al., 2025) also supports these findings, where Virtual Reality was shown to be more effective than conventional distraction techniques in reducing procedural pain in children.

Comparison With Other Research

However, some studies report results that are not entirely consistent. (Nordgård & Låg, 2021) found that the difference in effectiveness between virtual reality and conventional audiovisual distractions was not always significant, especially in younger children or during very short procedures. This could be due to limited time for children to adapt to virtual reality devices, discomfort with the headset, or very high initial anxiety levels that inhibit the effects of distraction (Chan et al., 2019). Differences in results between studies may also be influenced by variations in study design, the type of virtual reality content used, the duration of the intervention, and the characteristics of the respondents. In this study, the use of age-appropriate virtual reality content delivered immediately during the injection procedure allowed children to immediately engage with the virtual environment, maximizing the distraction effect. This supports the argument that content selection and intervention timing are critical factors in the success of virtual reality distraction.

CONCLUSION

Based on the results of a study of 36 children aged 3-12 years who underwent injection procedures at the Jakarta Islamic Hospital Cempaka Putih, it can be concluded that virtual reality distraction techniques have proven effective in significantly reducing pain and fear levels in children. This decrease is evident from the results of the Wilcoxon Signed Rank Test, which showed a significance value of 0.000 for all variables, both based on the child's and the researcher's assessment. The virtual reality intervention was able to shift the child's cognitive focus from the pain stimulus through an immersive sensory experience, thereby increasing the child's sense of control and comfort during medical procedures. The proportion of children who did not feel pain increased from 16.7% to 52.8%, while the proportion of children who were not afraid increased drastically from 2.8% to 72.2%. These findings strengthen empirical evidence that virtual reality technology can be integrated as a standard protocol for non-pharmacological pain management in pediatric nursing services, especially for invasive procedures that cause high anxiety. The application of this technology is not only beneficial for minimizing procedural trauma, but also increases child cooperation and reduces the psychological burden on parents and healthcare workers during medical procedures.

REFERENCES

Ali, S., Ma, K., Rn, N. D., Vandermeer, B., Scott, S., Beran, T., Issawi, A., Curtis, S., Jou, H., Graham, T. A. D., Ba, L. S., & Hartling, L. (2021). *Original Article A randomized trial of iPad distraction to reduce children ' s pain and distress during intravenous cannulation in the paediatric emergency department*. *August 2020*, 287–293. https://doi.org/10.1093/pch/pxaa089

Chan, E., Hovenden, M., & Ramage, E. (2019). *Virtual Reality for Pediatric Needle Procedural Pain: Two Randomized Clinical Trials*. 160–167.

Dumoulin, S., Thériault, J., & Dugas, C. (2019). Distraction techniques for children undergoing medical procedures: A comparative study. *Pain Management Nursing*, *20*(3), 231–238. https://doi.org/10.1016/j.pmn.2018.10.004

Fern, A., Dobarrio-sanz, I., & Mar, I. (2020). *New Technologies to Improve Pain , Anxiety and Depression in Children and Adolescents with Cancer : A Systematic Review*.

Gold, J. I., Mahrer, N. E., Yee, J., & Palermo, T. M. (2021). Virtual Reality for Pediatric Pain Management: A Randomized Controlled Trial in Clinical Settings. *Journal of Pediatric Psychology*, *46*(6), 478–689. https://doi.org/10.1093/jpepsy/jsab029

Gold, J. I., Soohoo, M., Laikin, A. M., Lane, A. S., & Klein, M. J. (2021). *Effect of an Immersive Virtual Reality Intervention on Pain and Anxiety Associated With Peripheral Intravenous Catheter Placement in the Pediatric Setting A Randomized Clinical Trial*. *4*(8), 1–14. https://doi.org/10.1001/jamanetworkopen.2021.22569

Jenabi, E., Bashirian, S., Salehi, A. M., Rafiee, M., & Bashirian, M. (2023). *Virtual reality for pain reduction during intravenous injection in pediatrics : a systematic review and meta-analysis of controlled clinical trials*. *66*(12), 533–537.

La, M. De, Herrera, C., Fuster-casanovas, A., & Catalina, Q. M. (2025). *Use of virtual reality in the reduction of pain after the administration of vaccines among children in primary care centers in Central Catalonia : Randomized clinical trial*. 1–17. https://doi.org/10.1371/journal.pone.0322840

Nordgård, R., & Låg, T. (2021). *The Effects of Virtual Reality on Procedural Pain and Anxiety in Pediatrics : A Systematic Review and*. *2*(July). https://doi.org/10.3389/frvir.2021.699383

Sahin, C., Cinakli, S., Atar, S., Gulten, B., Nur, T., & Duygu, T. (2025). The effect of virtual reality on skin prick test - related pain and fear in children : a randomized controlled trial. *European Journal of Pediatrics*, *April 2024*. https://doi.org/10.1007/s00431-025-06262-x

Sánchez-, M. I., Lluesma-, M., Tomás-, I., & Gutiérrez-, G. (2025). *The effect of virtual reality versus standard- - care treatment on pain perception during paediatric vaccination : A randomised controlled trial*. *May 2024*, 1045–1062. https://doi.org/10.1111/jocn.17287

Sayed, Y., Mohamed, S., & Abolwafa, N. (2020). Assessment of Pain Intensity among Preschool-age Children during Venipuncture. *Minia Scientific Nursing Journal*, *008*(1), 56–64. https://doi.org/10.21608/msnj.2020.188041

Tan, E. C., Yip, C. L., & Lim, S. H. (2023). Efficacy of virtual reality compared to conventional distraction techniques for reducing procedural pain in children: A meta-analysis. *Nurse Education Today*, *122*, 105730. https://doi.org/10.1016/j.nedt.2023.105730

Vitor, M. Z., Silva, T. L., Ph, D., Bitencourt, A. D. S., Fernandes, P., Ph, D., Echevarría-guanilo, M. E., Ph, D., Marques, L., Ph, D., Pina, J. C., Ph, D., Rocha, P. K., & Ph, D. (2025). Pain Management Nursing Virtual Reality for Pain Relief in Children During Vaccination : Randomized Pilot Study. *Pain Management Nursing*, *26*(6), e530–e538. https://doi.org/10.1016/j.pmn.2025.06.014