Conference Paper

The Impact of Implementation Virtual Reality (VR) on Pain Levels Among Children with Invasive Procedures: A Literature Review

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Abstract

The volume of hospitalized pre-school children has increased in recent years. More than 30% children have experienced hospital treatment and 5% have been treated several times in the hospital. They will undergo painful procedures with physical and psychological impacts. Various technological approaches to pain management have been developed, including the use of virtual reality therapy to reduce pain in pediatric patients. The purpose of this study is to conduct a literature review to the impact of using Virtual Reality (VR) on pain level among children undergoing invasive procedures. Literature review was conducted from 2010-2020 at the five largest databases consist of Pubmed, Google Scholar, CINAHL, Medline and Psycinfo by using keywords “Virtual Reality” “Pain”, “Children Pain”, “Pediatric Pain”, “Virtual Reality and Children Pain” and “Virtual Reality and ‘Pediatric Pain. From four articles discussed both acute and chronic pain, VR can be used to reduce pain or other symptoms related physiological stress during hospitalization

Keywords: Children, Pediatric, Pain, Hospitalization and Virtual Reality

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1. Introduction

The total of 5.9 million children in 2012 were hospitalized in USA or one every six patient discharged [1]. In Indonesia at 2014, the number of children treated in hospital was 15.26% [2]. This number will has increased every years because preschool children are susceptible to several diseases [3] About 30% children will experienced hospital treatment and approximately 5% have been treated several times in the hospital [4] Children will experienced invasive procedures including venous insertion, blood sampling or other tissues and surgery that caused both acute and chronic pain. Assessing pain in children is different from adults nurses must assess the responses, both verbally and non-verbally [5] Management to reduce pain in children widely known as pharmacological therapy and non-pharmacological therapy. Technology approach that can be done through combination entertainment and games is Virtual Reality (VR)

This technology had huge accessibility and immense application that will lead patient into virtual world for instance Snow World, Gorilla Exhibit, Aqua, Bear Blast, Feeding Frenzy and Shape Your Path with different purposes [6] Various studies describe the use of virtual reality therapy to reduce pain in pediatric patients who perform procedural measures compared to general measures that are routinely performed [7, 8]. However, there is currently no literature review that describes the impact of implementation of VR Based on this explanation, a literature review is needed to explore the differences in the effectiveness of the effect of virtual reality on pain reduction in pediatric patients therefore the intervention program planning in children will use a better atraumatic care approach.

2. Method

Searching literature were obtained from the five largest databases in health care entailed of Pubmed, Google Scholar, CINAHL, Medline and PsycINFO using the keywords *"Virtual Reality" "Pain", "Children Pain"*, "Pediatric Pain", *"Virtual Reality and Children Pain"* and *"Virtual Reality and 'Pediatric Pain"*. Keyword searches are also combined to obtain more specific results. Inclusion criteria include: 1) Article has a title and the content relevant to the purpose of the study, 2) The publication of the article is limited from 2010 to 2020, 3) English, and Full Text. Articles not included in the inclusion criteria are excluded. The process of finding literature is described in Figure 1 with the PRISMA flowchart approach.

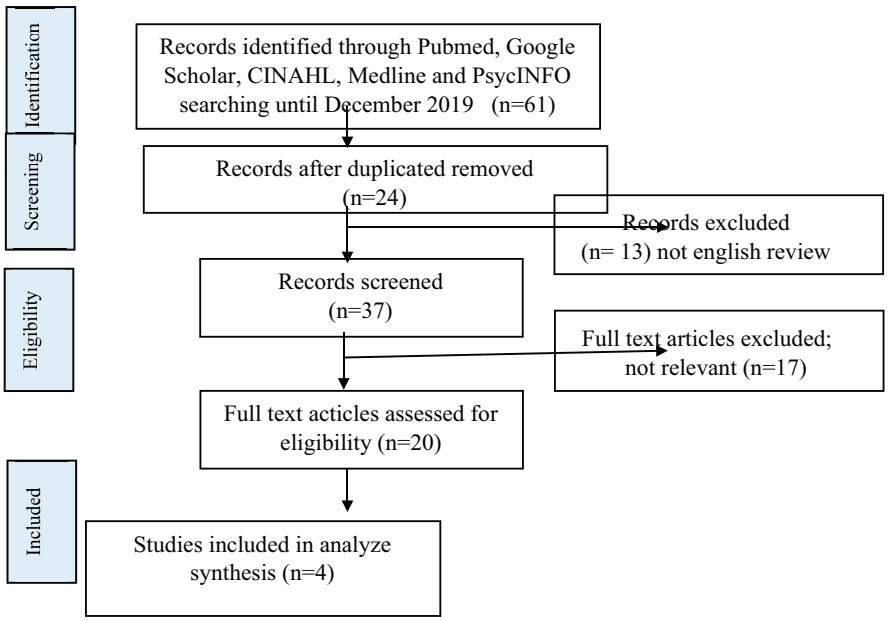

Figure 1: Review Article Process with PRISMA

3. Results

Table 1: Summary of Research Results

No	Title and authors	Sample	Method	Results	Conclusion
1.	Immersive Virtual Reality for Pediatric Procedural Pain: A Randomized Clinical Trial (Søren Walther-Larsen,Trine Petersen, Susanne, Friis, Gitte Aagaard, Bergitte Drivenes,, Pernille Opstrup, 2019)	A total of 64 children at urologic-genital surgery in The University Hospital Rigshospitalet Copenhagen, Denmark from March-May 2018 At final analysis, 28 sample in treatment group while 31 in control group	Design: Randomized and observer blinded clinical trial using computer for randomization Instrument: American Society of Anesthesiologists, Visual Analog Score (VAS), and patient satisfaction with 0- 100 scale During blood draw procedure children in the intervention group received *Seagull Splash* a 3D designed interactive game made and children in control group receive routine care	From the data analysis showed a high level of patient satisfaction in the intervention group. There is no statistically significant difference in pain scores among both groups.	Virtual Reality is a novel technology that can be used as a distraction technique to reduce pain during venous insertion compared to other routine care especially in children. This method is interesting, accessible, low cost and applicable for implemented for pain management or other purposes.
2	Is Virtual Reality Ready for Prime Time in the Medical Space? A Randomized Control Trial of Pediatric Virtual Reality for Acute Procedural Pain Management (Jeffrey,Gold,and Nicole E. Mahrer,2017)	The total of 143 children, caregivers, and phlebotomist were recruited in this study from the Children's Hospital Los Angeles, Department of Pathology Patient flow showed that 73 sample in VR group while 73 in control group	Design: Randomized controlled trial Instrument: Visual Analogue Scale (VAS), Colored Analogue Scale (CAS), Faces Pain Scale-Revised, Childhood Anxiety Sensitivity Index (CASI), Child Presence Measure Before and during blood draw procedure, patients interacted with the VR for five minutes while in control group get routinely standard of care in those hospital.	Demographic characteristics showed no significant differences among two groups from gender, age, grade, ethnicity and medical condition Patients in the VR reported less pain with better outcomes Anxiety level was influenced by VR stimulation	This study combine quantitative and qualitative data in pain management and satisfaction not only from children but by parents/caregiver and the phlebotomist Virtual reality in this study used Bear Blast multisensory (visual and auditory)

No	Title and authors	Sample	Method	Results	Conclusion
3	Virtual Reality: Endless Potential in Pediatric Palliative Care: A Case Report (Kevin Weingarten, Francis Macapagal, and David Parker,2019)	One sample was recruited in this study from palliative care department	Design: Case Report in a 12-year-old girl with high-risk acute myelocytic leukemia The implementation of VR guided by "Wishplay" during 5-10 minutes	After VR the patient feels going somewhere eventough stuck in the room She feel distracted from any pain, and loneliness and experienced new and exciting experience to distract her from the depressing and lonely situation	By the application of VR in Wishplay technology has the potential to improve patient quality of life and enhance the range of services offered in inpatient, outpatient, or home settings.
4	Virtual Reality for Pediatric Needle Procedural Pain: Two Randomized Clinical Trials Chan, E., Hovenden, M., Ramage, E., Ling, N., Pham, J. H., Rahim, A.,... & Jeyachanthiran, K. (2019)	All chidren aged 4-11 years at emergency and outpatient department undergoing venous needle procedures at 2 tertiary hospitals in Australia In emergency department, the total of 64 children were assigned to intervention group and 59 to standard care while in pathology department 63 children in VR group and 68 to control group	Design: Randomized controlled trial Instrument: Faces Pain Scale-Revised (FPS-R) suggested by the Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (PedIMMPACT) for children aged 4-12 years, Child-rated Anxiety and Visual Analogue Scale Virtual reality used in this study is an interactive underwater adventure in aquatic environment	Regression analysis described that VR statistically significant decreased pain in ED and pathology units Almost all children in VR group wanted this intervention again in the future and the majority of caregivers recommend to use use VR	The level of pain, anxiety, and distress were reduced after VR intervention in two intervention groups This technology was safe and effective for children during invasive needle procedures

4. Discussion

Three articles were using Randomized Controlled Trials [9, 10, 12] and article discussed using case report study [11]. In studies of VR in pediatrics, the large effect size suggests that VR is an effective intervention to reduce pain and anxiety in pediatric patients undergoing various medical procedures. The effect of VR on pediatric pain was particularly significant when observed by caregivers. virtual pain relief is a valid tool for non-pharmacological pain reduction and that this approach is preferred over standard reduction techniques currently in use. Although VR is an effective tool for pain relief,

most studies have investigated its effect on acute pain alone. For this reason, more research is needed to better understand the effects of VR on the pediatric population, on both acute and chronic pain

5. Conclusion

From these 4 articles above it can be concluded that VR have a positive effect and effective on reduce pain scales in hospitalized children who experienced invasive procedures. This technique had low cost, accessible without any negative impacts. In practice, the effectiveness of VR therapy involves self-confidence both in the mind and heart with full concentration therefore as healthcare professionals must lead children during the application to give maximum impacts.

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