

Review Article

Virtual reality games as a pain and anxiety reduction in circumcision children: A literature review

Dadik Dwi Fata Suparda* , Ninuk Dian Kurniawati , Andri Setiya Wahyudi 

ABSTRACT

Introduction: Circumcision is a minor surgical operation that cuts the foreskin at the tip of the penis. Pain and anxiety are problems that all children who undergo surgery experience. This study aimed to review virtual reality game interventions to reduce pain and anxiety from pre, intra, and post-circumcision in children.

Methods: Literature study using four databases (Scopus, Science Direct, PubMed, and Google Scholar) using quantitative research with RCT and quasi-experimental designs, using virtual reality, audio-visual and game interventions which were limited from 2018 to 2022 according to combination of keywords and using English. The framework investigation using PICOT, guidance protocol with PRISMA, and accessing the eligibility of articles systematically by checking for duplicates, titles, and abstracts and determining the eligibility of the full text according to the study of the goals.

Results: Thirteen articles met the inclusion criteria. Of the thirteen articles, 1074 children were circumcised. Circumcision causes pain and anxiety in children, so non-pharmacological interventions are needed to overcome it. Virtual reality games are a distraction technique to reduce circumcision pain by diverting the child's attention and reducing anxiety by providing interventions that children like using audio-visual media and games, with virtual reality or not.

Conclusions: Virtual reality games intervention is a distraction technique to reduce pain and anxiety in circumcised children. The combination of interventions using traditional games or the latest technology must be considered to improve service quality.

Keywords: anxiety; children; circumcision; distraction technique; pain

INTRODUCTION

Circumcision is the oldest surgical procedure and is often performed by people worldwide. Surgery to cut the foreskin at the tip of the penis is carried out for various reasons, such as religious, cultural, and medical reasons and also men's (Bellieni, 2022; Prasetyo, 2018). Circumcision surgery is a minor surgical procedure but is considered painful by children, so it can cause anxiety in children (Munevveroglu & Gunduz, 2020; Suzan et al., 2020). This can lead to disturbed sleep patterns, irregular eating patterns, lack of cooperation, child dissatisfaction, and slow recovery. Therefore action is needed to overcome or reduce pain and anxiety in circumcised children to prevent poor health care (Eijlers et al., 2019).

As many as 38% of men in the world perform circumcision. Most circumcision is performed in Middle Eastern countries,

where more than 90% perform circumcision because the majority are Jews and Muslims (Gologram et al., 2022). Out of 237 countries in the world, 92.5% of males in Indonesia perform circumcision, and in the United States, as many as 80.5% (Morris et al., 2016). Medically, there is no age limit for men to perform circumcision. However, in Indonesia, boys who perform the most circumcision are aged 5-12 years, namely 85% or 8.7 million children (Karita & Romdhoni, 2018). As many as 26.7% of children did not experience anxiety before circumcision, 53.3% experienced moderate anxiety, and 20% experienced severe anxiety (Ayuni et al., 2023). Meanwhile, the pain experienced by post-circumcision children was 70.6% mild, 14.4% moderate pain, and 15% severe pain (M. Fadel Dikaprio et al., 2021).

Management to overcome or reduce pain and anxiety in children requires pharmacological and non-pharmacological methods (Adler et al., 2021; Mohammadi et al., 2019), and this is the responsibility of health workers to maintain patient safety (Setyaningsih & Wahyuni, 2020). Pharmacological interventions can cause some side effects, such as nausea and vomiting. Sedatives can also cause agitation, delirium, and even cause pain (Mehrotra, 2019). Alternative approaches can be taken in the form of non-pharmacological interventions. Practical and straightforward non-pharmacological interventions do not require expensive equipment, do not cause side effects, and can be performed at any time (Kumar et al., 2020). Some literature mentions non-pharmacological

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*Correspondence: Dadik Dwi Fata Suparda (dadik.dwi.fata-2021@fkip.unair.ac.id)
Faculty Of Nursing, Universitas Airlangga, Surabaya, Indonesia

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measures to treat pain and anxiety in children, including hypnosis, distraction, music, painting, films, games, tablet applications, video games, and cognitive behavioral therapy (Gómez-Urquiza *et al.*, 2016; Wong *et al.*, 2019).

Technology-based distraction interventions can effectively divert attention to reduce pain and anxiety felt by patients (Alqudimat *et al.*, 2021). Innovative technology-based interventions via mobile phones such as games, video streaming, and immersive videos for children, are still being studied further (Rantala *et al.*, 2020). Other studies have also conducted game-based and audio-visual research to reduce pain and anxiety in children (Cheraghi *et al.*, 2021; Singh *et al.*, 2023; Suzan *et al.*, 2020).

Many studies have been conducted to treat pain and anxiety in children, but pre-, intra-, and post-circumcision procedures still need to be carried out and developed. A review of several articles also needs to be done to add to the evidence base, and the research that has been done also needs to be summarized. This study aims to review virtual reality game interventions to reduce pain and anxiety from pre-, intra-, and post-circumcision in children.

Table 1. PICOT Format

Criteria	Inclusion	Exclusion
Population	Circumcised boy	Not circumcised boy
Intervention	Virtual reality OR audio-visual OR game	Not using virtual reality OR audio-visual, OR game
Comparators	No comparison	No comparison
Outcomes	Decrease pain and anxiety	Not decrease pain and anxiety
Time	2018-2022	Timeless than 2018
Language	English	Not English
Article type	Full text and original research	Not a complete text; in the abstract, there is no mention of the intervention being carried out, Not RCT or Quasi-experiment, or article review.

the research conducted can reduce pain, anxiety circumcision in children, e) Time, the last five years. The search strategy uses the right keywords to improve research quality. The keywords used to search for articles based on Medical Subject Heading (Mesh) are combined using the Boolean words AND and OR. The search strategy is “virtual reality” OR “audio-visual” OR “game” OR “play” AND “circumcision” AND “child” OR “young” OR “boy.” The search results are limited to quantitative designs such as RCT and quasi-experiments using English.

Study Selection

A search was conducted through four databases and found 292 articles (Figure 1), found 15 duplicate articles, and obtained 277 articles. Researchers assessed and filtered titles (n=31), obtained abstracts (n=15), and obtained full text and met the inclusion criteria (n=13). We found thirteen full-text articles that could be used for the literature review. In filtering the literature, the researcher explains the reasons for the exclusion criteria, namely irrelevant articles, design review articles, interventions not focused on virtual reality, audio-visual and games, circumcision not in boys, data, and results not relevant and not complete text.

Data Extraction and Analysis

Relevant data studied included authors, methods, country,

METHODS

Design

A comprehensive literature review was conducted and synthesized from articles relevant to virtual reality, audio-visual, and play interventions to treat circumcision pain and anxiety in children. Evaluation of the literature review using PRISMA, all interventions and research results were recorded and included in the list of research literature.

Search Strategy

The literature search used four databases: Scopus, Science Direct, Pub Med, and Google Scholar. Limited database search for the last five years, in 2018-2022, to review articles. The framework investigation used the PICO-T (Eriksen & Frandsen, 2018) according to the inclusion and exclusion criteria (Table 1). The inclusion criteria in this study were a) Population, circumcised boys; b) Intervention, actions taken included virtual reality, audio-visual, and games; c) Comparing, not using comparison; d) Outcome, the results of

age, sample size, interventions, and study results. Conducting a literature review aims to obtain evidence based on pain and anxiety from pre-, intra-, and post-circumcision in children.uplicate responses.

RESULTS

Study characteristics

Thirteen articles were found from four databases. There were 28 journals from ScienceDirect, 63 journals from PubMed, 5 journals from Scopus, and 196 journals from Google Scholar, which met the inclusion criteria (Table 1). Three interventions that fit the inclusion criteria include virtual reality (n = 4) (Buyuk *et al.*, 2021; Firmansyah *et al.*, 2021; Hassannia *et al.*, 2021; Luo *et al.*, 2022), audio-visual (n = 2) (Bulut *et al.*, 2020; Idris *et al.*, 2020) and games (n=7) (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021; Gezginci *et al.*, 2021; Kurt & Seval, 2021; Pazarcikci & Efe, 2022; Suzan *et al.*, 2020; Ünver *et al.*, 2020, 2021). Data collection used a quantitative design with RCT research methods (n = 11) and Quasi-experiments (n = 2). One thousand seventy-four children underwent circumcision between the ages of 3 and 18. Research according to the literature review was conducted in Turkey (n=8) (Bulut *et al.*, 2020; Buyuk *et al.*, 2021; Gezginci *et al.*, 2021; Kurt

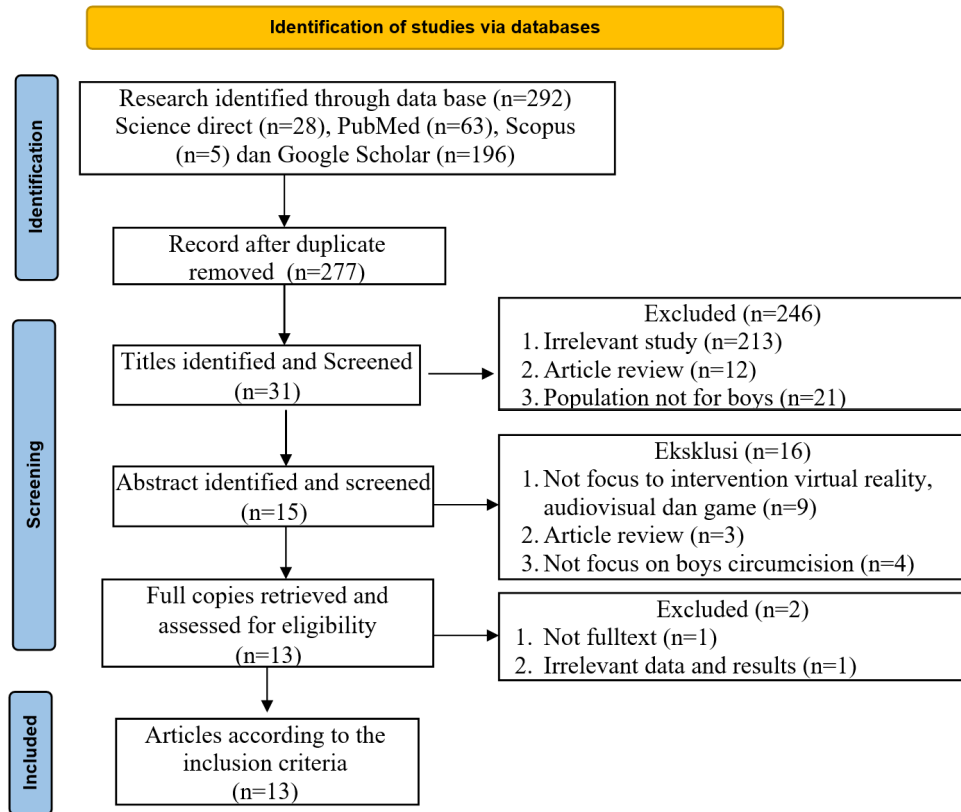


Figure 1. PRISMA Flowchart

Table 2. Study Characteristics and Findings

No	Author	Method	Sample and age	Intervention	Outcome	Result
1	(Buyuk et al., 2021)	Randomized controlled experimental study	78 boys (5-10 years old)	Using Virtual reality with a duration average of 4,5 min before circumcisions. The boy thought he was walking in the Amazon Forest, which has many trees. The child feels that he is playing water skiing.	Children's fear scale (CFS) Children's anxiety meter scale (CAM-S) Wong-Baker faces pain rating scale (WBS)	The average value of Cam-S, CFS in the pre- and post-operative obtained $p < 0,001$ (p -value $< 0,05$), which means there is a change in anxiety and significant fear of the VR group to the control group. For WBS, $p < 0,01$ (p -value $< 0,05$) means a post-operative pain decrease.
2	(Luo et al., 2022)	Randomized controlled study	106 children (7-18 years old)	Children wear virtual reality after entering the operating room until the circumcision is complete. Video demonstrating are 1. Biofilik-VR (BVR) 2. Indoor-VR (IVR)	1. Yale Pre-operative Anxiety Scale (CmYPAS) 2. Faces Pain Scale-Revised (FPS-R) 3. Visual Analogue scale (VAS)	BVR and IVR group scores in CMYPAS, FPS-R, and VAS during operation are significantly lower than the control group, as evidenced by the value of $p < 0,001$ (p -value $< 0,05$), which means virtual reality is effective for reducing pain and anxiety during circumcision.

No	Author	Method	Sample and age	Intervention	Outcome	Result
3	(Hassannia et al., 2021)	Single-blind randomized clinical trial	40 children (5-10 years old)	Children using virtual reality before and during circumcision. The video shown is in full HD: 1. Video about the operating environment, fun experience, and recommendations after surgery for 4 minutes and 35 seconds 2. During circumcision, the patient will be shown the Tom and Jerry series video (\pm 20 minutes)	1. Observational Scale of Behavioral Distress Revised (OSBD-R) 2. Oucher pain scale	Mann Whitney test obtained $p < 0,001$ (p -value $< 0,05$) in anxiety and pain at the beginning of the circumcision, during anesthesia injection, and anxiety after the circumcision is completed. As for pain at the end of circumcision, the value of $p = 0,005$ (p -value $< 0,05$) shows that significantly using VR can reduce pain and anxiety during circumcision in the child.
4	(Firmansyah et al., 2021)	Quasi-experimental with pretest-posttest control group design	60 children preschool	Children using Google virtual reality show cartoon movies. Virtual reality is used during circumcision.	Hamilton Anxiety Rate Scale (HAM-A) and facial scale	The results of anxiety using the HAM-A and the facial anxiety scale obtained a value of $p = 0.000$ which indicates that there is a significant effect of using VR to reduce children's anxiety during circumcision
5	(Suzan et al., 2020)	Randomized controlled experiment	81 children (7-11 years old)	The nurse plays a puppet show with the child in the operating room for 10 minutes and one minute after being given local anesthesia.	1. Wong-Baker Faces Pain Rating Scale 2. State-Trait Anxiety Inventory for Children	Obtained a value of $p < 0,000$ (p -value $< 0,05$) for pain and anxiety, which means that puppet shows can reduce children's pain and anxiety during circumcision and follow-up care
6	(Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021)	Randomized clinical trial	60 children (3-6 years old)	Children are encouraged to play games using a tablet computer when they go to the operating room until the induction of anesthesia.	1. Modified Yale Pre-Operative Anxiety Scale (mYPAS) 2. Face, Legs, Activity, Cry, Consolability (FLACC) scale (< 7 years.) 3. Visual analog scale (VAS) scale (> 7 years.) 4. Pediatric Anesthesia Emergence Delirium (PAED) scale	The use of games using a tablet computer can reduce the anxiety of children undergoing surgery which is proven by mYPAS 55,7 vs. 65,8, 95% CI, -0,63 to 20,8

No	Author	Method	Sample and age	Intervention	Outcome	Result
7	(Pazarcikci & Efe, 2022)	Randomized controlled trial	120 children (4-7 years old)	1. Before the operation, the children were read a story about their son's circumcision experience. 2. Provide therapeutic games in the form of dolls and medical devices. Coloring crossword book. 3. Give a prize in the form of a Superior Bravery Medal	1. Children's Anxiety Meter State (CAM-S) 2. Children's Fear Scale (CFS)	The $p = 0,025$ for the CAM-S variable and $p = 0,001$ for the CFS variable where the p -value $< 0,05$, which means that providing comfort-oriented nursing care can reduce the anxiety and fear of children undergoing circumcision.
8	(Gezginci et al., 2021)	Randomized controlled trial	70 children (8-12 years old)	The children were encouraged to play games on the tablet prepared by the researchers for 5 minutes before the circumcision until the end of the procedure.	1. Numerical Rating Scale (NRS) 2. State-Trait Anxiety Inventory for Children (STAI) 3. Physiological parameters	The use of tablets can reduce pain and anxiety in circumcised children, as evidenced by the Wilcoxon test of pain and anxiety during the procedure $p < 0,001$ (p -value $< 0,05$).
9	(Idris et al., 2020)	Quasi experimental design	98 children (10-13 years old)	Children are visually distracted during invasive procedures by looking at and holding needles.	Wong-Baker Faces Pain Scale (WBFPS) or facial pain intensity scale	Distractions such as looking at and holding the needle can reduce pain for invasive procedures during circumcision, as evidenced by the mean control and experimental group 6,53 vs. 0,49 with a $p = 0,000$ (p -value $< 0,05$).
10	(Ünver et al., 2020)	Randomized controlled trial	94 children (7-12 years old)	The children played Jenga with the accompanying nurse and parents, namely, playing with building blocks to form towers so that they were tall.	1. Facial Affective Scale (FAS) 2. Visual Facial Anxiety Scale (VFAS)	Playing Jenga can reduce a child's anxiety and pain after a minor surgery ($p < 0,05$), decreased anxiety in the intervention group ($p = 0,006$), and the need for analgesic drugs for the intervention group was lower than the control group ($p = 0,048$).
11	(Bulut et al., 2020)	Randomized controlled trial	140 children (7-11 years old)	The children listened to music therapy played through pillows made of music for 20 minutes and every 20 minutes 1 hour after the patient was brought into the room.	1. Wong-Baker Faces 2. Children's Fear Scale 3. Baxter Animated Faces 4. Retching Faces 5. Pre-operative Anxiety Scale	Music therapy can reduce the fear and anxiety of children after circumcision surgery, as evidenced by the CFS value of the intervention 30 minutes and 2 hours after the intervention, $p = 0,000$. For Face Wong-Baker, the score is $p = 0,000$ (p -value $< 0,05$).

No	Author	Method	Sample and age	Intervention	Outcome	Result
12	(Kurt & Seval, 2021)	Randomized controlled trial	90 children (1-5 years old)	A nurse or patient mother playing finger puppets with children	1. Children's Hospital of Eastern Ontario Pain Scale in Young Children (CHEOPS) 2. PedsQL Health Care Parent Satisfaction Scale	Finger puppet games can reduce post-operative pain in children with a mean value of 7,130 (playing with a nurse) and a mean value of 6,470 (playing with parents), while in the control group, the mean value is 9,470
13	(Ünver et al., 2021)	Randomized controlled trial	37 children (7-12 years old)	Kids played the building block game until they were a tall tower beside their bed 15 minutes after leaving the recovery room	1. Facial affective scale (FAS) 2. Visual Analog Scale (VAS)	Children who play games with their parents can reduce the pain and anxiety they feel after surgery, as evidenced by the mean control and experimental group 1,82 vs. 0,70 with a p<0,001 (p-value <0,05)

& Seval, 2021; Pazarcikci & Efe, 2022; Suzan et al., 2020; Ünver et al., 2020, 2021), China (n=1) (Luo et al., 2022), Iran (n=1) (Hassannia et al., 2021), Indonesia (n=2) (Firmansyah et al., 2021; Idris et al., 2020) and Denmark (n=1) (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021). The following are the characteristics of the study of boys circumcision using virtual reality, audio-visual and game interventions which are presented in Table 2.

Characteristics of the intervention

Virtual reality

Virtual reality is a distraction method that can be applied to reduce pain (Buyuk et al., 2021; Hassannia et al., 2021; Luo et al., 2022) and anxiety in children undergoing circumcision (Buyuk et al., 2021; Firmansyah et al., 2021; Hassannia et al., 2021; Luo et al., 2022). This virtual method uses special glasses to see various kinds of virtual images, and they can also listen to the sound produced by the virtual. Indirectly, they can feel the virtual world realistically and interact with the environment they see (Baños et al., 2013; Hassannia et al., 2021). The virtual reality tools used include VR BOX 3.0 with white VR glasses. Compatible with iOS and Android smartphones with a size of 4-6 inches weighing 0.414 kg (Buyuk et al., 2021), VR glasses (Unity3D 2018.3.10f1, Shu Rui Medical) weighing 350 gr (Luo et al., 2022), virtual reality headsets (Remax-RT-V03) (Hassannia et al., 2021), google virtual reality (VR) (Firmansyah et al., 2021).

The videos presented in virtual reality vary, offering virtual reality in the Amazon forest where there are many shady trees there and providing the experience of water skiing (Buyuk et al., 2021), Biophilic VR (BVR), which displays rural views as the blue sky clear. Sunny, white clouds, flowing water, trees blowing in the wind, birds flying, and accompanied by soft music, Indoor VR (IVR) displays an apartment on the top floor with large windows. There is some furniture in the apartment, such as a TV (Luo et al., 2022), instructional videos regarding the operating environment, pleasant circumcision experiences, and recommendations after circumcision, Tom and Jerry serial videos (Hassannia et al., 2021), cartoon videos (Firmansyah et al., 2021).

The duration and average viewing time using VR is 4.5 minutes before circumcision surgery (Buyuk et al., 2021), VR is used for 4 minutes 35 seconds before circumcision, and about 20 minutes from the start of circumcision to the end of the procedure (Hassannia et al., 2021), VR is used at the time of circumcision, namely from the time the child enters the operating room until the circumcision is complete (Firmansyah et al., 2021; Hassannia et al., 2021; Luo et al., 2022).

Audio-visual

Audio-visuals can reduce pain during circumcision (Bulut et al., 2020; Idris et al., 2020) and the anxiety of children undergoing circumcision (Bulut et al., 2020). The audio used is music therapy through creative music pillows featuring classical music, The Art of The Fugue of Bach, which consists of 18 chapters (Bulut et al., 2020). Actions performed visually are by looking at and holding the needle (Idris et al., 2020). The duration and execution time using audio is 20 minutes during the circumcision procedure. After 1 hour, the patient is in the room (Bulut et al., 2020) during an anesthetic injection (Idris et al., 2020).

Game

Playing games can reduce pain (Gezginci et al., 2021; Kurt & Seval, 2021; Suzan et al., 2020; Ünver et al., 2020, 2021) and child anxiety during circumcision (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021; Gezginci et al., 2021; Pazarcikci & Efe, 2022; Suzan et al., 2020; Ünver et al., 2020, 2021). Play therapy can be done independently (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021; Gezginci et al., 2021) and can also be done together with other people, such as parents or nurses (Kurt & Seval, 2021; Pazarcikci & Efe, 2022; Suzan et al., 2020; Ünver et al., 2020, 2021). Games played independently are online games (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021; Gezginci et al., 2021). Games played with parents or caregivers include puppet shows (Suzan et al., 2020), amigurumi dolls and medical equipment (Pazarcikci & Efe, 2022), finger puppets (Kurt & Seval, 2021), Jenga (Ünver et al., 2020, 2021).

The forms of games played include online games, which contain 50 different games that are appropriate for the age of the child (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, & Hansen, 2021), play game with Jenga, Jenga is a game that requires 54 blocks wood-arranged on a flat surface to make towers (Ünver et al., 2020), using handmade dolls made of socks, rope, cardboard and colored markers. There are four dolls, two boys and two girls (Suzan et al., 2020), finger puppets with animal shapes such as lions, spiders, elephants, and rabbits (Kurt & Seval, 2021), amigurumi dolls (dolls with shoes and removable clothing), medical device equipment (stethoscope, bonnet, thermometers, patient armbands, masks, surgical gown, and mobile beds) (Pazarcikci & Efe, 2022).

The duration and time of execution in the pain management game are 15-20 minutes (Pazarcikci & Efe, 2022), 10 minutes in the operating room, and 1 minute until anesthesia is given (Suzan et al., 2020), 5 minutes before circumcision until the procedure is complete (Gezginci et al., 2021), 15 minutes after leaving the recovery room (Ünver et al., 2021), 1 hour after the child is conscious or out of the recovery room (Kurt & Seval, 2021). Games duration and implementation time to overcome anxiety are 15-20 minutes (Pazarcikci & Efe, 2022) and 10 minutes during circumcision in the operating room (Suzan et al., 2020). Children play games from arriving in the operating room until anesthesia is given (Clausen, Madsen, Rosenkilde, Hasfeldt-Hansen, Larsen, Hansen, et al., 2021), 5 minutes before circumcision until procedure is complete (Gezginci et al., 2021), 15 minutes – 1 hour before entering the operating room (Ünver et al., 2020, 2021), after admission to the pre-operative room (Ünver et al., 2020).

DISCUSSION

This research focuses on virtual reality, audio-visual and game interventions to address the pain and anxiety of boys undergoing circumcision. Virtual reality, audio-visual, and game intervention are distraction techniques to reduce pain and anxiety in children undergoing circumcision surgery. Every child's pain and anxiety levels differ depending on their threshold level. The response to pain is very individual, this depends on the child's age, the experience of pain, the support provided, and coping abilities (Setyaningsih & Wahyuni, 2020). The pain felt by a child undergoing circumcision ranges from administering anesthetic injections to pain after circumcision surgery.

The anxiety faced by every child who undergoes circumcision surgery is also different. Some feel happy, and some fear facing minor surgery because it depends on their perception, motivation, and stressor. Based on the cognitive model of anxiety, differences in children's responses to anxiety are caused by a lack of information obtained (Kaltenthaler et al., 2006) and differences in support systems such as assistance by parents or with those closest to them (Firmansyah et al., 2021). Risk factors that can change negative post-operative behavior are pre-operative anxiety, being too young, premedication, previous surgical experience, and high parental anxiety (Hatipoglu et al., 2018; Stargatt et al., 2006).

Non-pharmacological distraction is a simple technique that is easy to reduce children's pain and anxiety. Virtual reality can be used to reduce patient pain and anxiety, which results in high satisfaction levels (Gold & Mahrer, 2018). Gamification is a fun activity that can be used in surgery preparation and post-surgery care. Several studies have also shown that children who receive educational interventions

through media show lower anxiety about surgery and other hospital procedures (Fernandes et al., 2014). Non-pharmacological methods are rarely used to treat pain and anxiety in children, especially during the pre-operative period and during anesthesia induction, even though game-based interventions can provide opportunities for children to learn about the hospital environment and the treatments to be performed. given (Rantala et al., 2020). Gamification can also be given to improve the mental, physical, and emotional health of children after surgery or after hospitalization (Lestari et al., 2017). Reducing the pain and anxiety patients feel can accelerate the recovery and rehabilitation period and reduce the need for drugs to help reduce medical costs (De Moura et al., 2016).

Based on the findings, the duration for reducing pain and anxiety in child circumcision uses a virtual reality intervention of at least 4 minutes until the circumcision procedure is complete; audio-visual intervention is carried out when anesthesia injection or up to 20 minutes during the circumcision procedure and continues again when already in the recovery room, intervention game at least 5 minutes before circumcision until the circumcision procedure is complete and can be continued 1 hour after surgery.

In our view, these three interventions can and easily be carried out depending on the availability of tools, needs, habits, interests, and age of the child. Unlike virtual reality, this depends on the availability of Google VR tools. The Jenga game requires block-shaped equipment to be arranged into a tower to play it. Playing with dolls also requires dolls that children like so that the intervention can be applied optimally. Meanwhile, watching movies or playing online games requires a device in the form of a smartphone. The effectiveness of the intervention depends on the child's interests because each child has unique and different characteristics to reduce the pain and anxiety they experience. However, based on our findings, Virtual reality games are the more effective and most beneficial intervention to reduce the pain and anxiety of circumcised children, as evidenced. Children enjoy singing and listening to music to reduce anxiety effectively (Giordano et al., 2020). Visually, seeing and holding needles is a distraction to reduce pain (Bascour-Sandoval et al., 2019) during the procedure. Intervention can be done through virtual reality or not.

The limitations of this literature study are the distraction technique studied only identified three interventions and only reviewed articles using English. The research method is only quantitative with RCT and quasi-experimental designs. Several aspects of exploring the child's experience using the intervention must also be considered to determine comfort in carrying out the intervention.

CONCLUSION

Virtual reality games intervention is some of the distraction techniques to reduce pain and anxiety in children undergoing circumcision surgery. Combination interventions with traditional games or the use of electronic media following technological developments must be considered to improve the quality of service to the community.

Declaration of Interest

The authors do not have any conflict of interest.

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Author Contribution

DS found problems related to child circumcision, NK and AW provided input on how to write and how to solve these problems. DS conducted a journal search according to inclusion and exclusion. DS, NK and AW discussed the results and write the manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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