Journal of Multidisciplinary Healthcare

Dovepress
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REVIEW

A Scoping Review of Audiovisual Distraction Techniques Among Children in Reducing Invasive Procedure Pain

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Background: Invasive procedures in children can lead to painful and uncooperative procedures. It is essential to determine the appropriate method to create a comfortable environment for children during invasive procedures. However, audiovisuals are one of the distraction techniques used in pain management.

Purpose: This study aims to identify and categorize related audiovisual distraction techniques in reducing pain due to invasive procedures among children.

Methods: This study uses a systematic scoping review. A literature review was conducted using PubMed, EBSCO, Science Direct, Scopus and grey literature through Google Scholar. The study was eligible for inclusion if it included articles published from 2012 to 2022, full-text and open accessed articles, and in Indonesian and English language. Studies were excluded if they were review studies and the adult population. The keywords in English were *"Children" OR* 'Child' *OR "Kids" OR* 'Youth' *OR* 'Adolescents' *OR* 'Teenager' *OR* 'Teens' *OR* 'Young People' *OR* 'Pediatric' *OR* 'Paediatric' *OR* 'Childhood' *AND "Audiovisual" OR* 'Movie' *OR* 'Video' *OR* 'Animation' *AND "Pain" AND "Invasive procedures" and keyword in Indonesia were "Anak" OR* 'Remaja' *OR* 'Bayi' *OR* 'Balita' *AND "Audiovisual" OR* 'Film' *OR "Video" OR* 'Animasi' *OR "Nyeri" AND* 'Prosedur invasif'.

Results: We found 15 articles showing audiovisual distraction techniques in managing pain among children undergoing invasive procedures. Three types of audiovisual interventions were used, including virtual reality (VR), video music, and animated cartoons. In addition, types of invasive procedures that benefited from the analyzed interventions were infusion, surgery, injection, blood draw, dressing change, circumcision, endoscopy, and phlebotomy.

Conclusion: Our findings highlight that virtual reality, video music, and animated cartoons have clinical implications in helping to distract from pain in children undergoing invasive procedures. Our study indicates that the potential of audiovisual intervention can be used as an intervention strategy in the pediatric nursing area.

Keywords: audiovisual, child, invasive procedures, pain

Introduction

When experiencing hospitalization, the child will receive treatment and medical measures.[1] Invasive procedures are one of the most common procedures encountered when children are hospitalized,[2,3] such as injection, infusion, catheter insertion, wound care and other invasive procedures.[4] Worldwide, approximately 230,000,000 invasive procedures are performed each year.[3] Based on the 2017 Indonesian Demographic Health Survey by Kemensos (2018), It is estimated that in Indonesia, as many as 90% of children are brought to health facilities.[5]

Received: 20 May 2024
Accepted: 30 August 2024
Published: 7 September 2024

Continuous invasive procedures performed on children can lead to painful conditions.[6,7] The pain of invasive procedures experienced by children can cause discomfort, worry and crying.[8,9] Pain conditions experienced by children can cause children to be uncooperative and even refuse action procedures so that they can become obstacles in the healing process.[5,6,10,11]

It is essential to determine the appropriate method of creating a comfortable environment for the child during the invasive procedure.[12] Pain management is needed so that children do not feel pain or the pain scale is reduced in invasive procedures.[13] The role of nurses is to intervene in care to overcome patient pain problems through a nonpharmacological approach,[14,15] so that the child can tolerate pain and control the situation, have a shallow risk, and help pharmacological methods.[16] According to previous studies, distraction techniques are one of the nonpharmacological methods that can relieve or minimize pain.[12,13]

A review revealed that psychological interventions such as distraction techniques are promising and often used to help reduce procedural pain.[17] Distraction is defined as the diversion of attention from pain stimuli.[18,19] Some types of distractions that are effective in reducing pain include auditory distraction, visual distraction, and cognitive distraction.[18,20] Distraction can suppress pain-related nervous system activity; activity in neurons in the cornu dorsal medulla that respond to pain will be reduced. Distraction provides analgesic stimulation through the release of endogenous opioids at opioid receptor sites. Activation of opiate receptors in the interneuronal (spinal cord) results in hyperpolarization of neurons that inhibit firing. The periaqueductal grey (PAG) area plays a role in the modulation of pain control systems that inhibit pain information at the spinal cord level. The experience of pain is processed in different areas of the brain. The sensory aspect of pain occurs in the primary sensory cortex (S1), while the affective dimension of pain occurs in the anterior cingulate cortex (ACC). In addition, when an attentional stimulus is presented, activation occurs in the ACC, PAG, and posterior thalamus regions. Brain regions involved in pain modulation during distraction.[19,20]

Previous studies mention that Audiovisual is used as one of the distraction techniques in overcoming pain in children.[21] Children also favor 17 Audiovisual because of its attractive appearance.[22] In line with the study by Colin et al, it showed the effect of distraction techniques by watching animated cartoons on reducing the pain scale during injection in preschool children.[23]

To our knowledge, no review studies currently identify the different types of audiovisuals used in pain distraction in children undergoing invasive procedures. However, comprehensive information is essential to provide conclusive new knowledge regarding the effect of audiovisual distraction on pediatric pain from invasive procedures in the context of audiovisual type and pediatric population. Therefore, this study aimed to identify and categorize audiovisual distraction techniques in reducing pain from invasive procedures among children.

Material and Methods

Study Design

This study used the scoping review method that follows the framework byArksey and O'Malley.[24,25] This method is a systematic approach to interpreting the results and mapping the concepts underlying the topic of the study area.[26] Conduct the study using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR).[27] Several stages of research were carried out, including identifying the review's focus, identifying relevant studies, selecting studies, collecting and extracting data, compiling, summarizing, and reporting the results.[26,28]

Search Strategy

Articles were searched through five databases, namely PubMed, EBSCO, Science Direct, Scopus, and grey literature, using Google Scholar. The research questions used the PCC (Population, Concept, and Context) research framework guidelines.[29] Children as Population, Invasive Procedure Pain as Concept, and Audiovisual as Context.

Keyword searches in English and Indonesian applied Medical Subject Heading (MeSH) Terms and Boolean operators (AND and OR) and (AND and OR). English keywords were *"Children" OR* 'Child' *OR "Kids" OR* 'Youth' *OR*

'Adolescents' *OR* 'Teenager' *OR* 'Teens' *OR* 'Young People' *OR* 'Pediatric' *OR* 'Paediatric' *OR* 'Childhood' *AND "Audiovisual" OR* 'Movie' *OR* 'Video' *OR* 'Animation' *AND "Pain" AND "Invasive procedures" and keyword in Indonesia were "Anak" OR* 'Remaja' *OR* 'Bayi' *OR* 'Balita' *AND "Audiovisual" OR* 'Film' *OR "Video" OR* 'Animasi' *OR "Nyeri" AND* 'Prosedur invasif'.

Eligibility Criteria

The inclusion criteria for this study are articles published from 2012 to 2022, full-text and free-text articles, Indonesian and English language, invasive procedure pain, and studies that focus on hospitalized children. Studies will be excluded if the study design is literature review type and the population is swine. All researchers independently screened articles and appraised study quality.

Data Extraction and Analysis

Data were extracted using the tabulation method in Microsoft Excel (Microsoft Corp., New York, USA) and presented as a tabular matrix. The components analyzed in this study are (1) Study characteristics, including author, study design, country, intervention type, type of invasive procedure, age, and sample; (2) Percentage analysis of the impact of audiovisual in reducing invasive pain in children by demographic variables in selected studies, including country region, study design, type of intervention related to age (years old), type of invasive procedure; (3) Grouping of audiovisual distraction types and intervention results including author, intervention type, type of invasive procedure, and result. We then analyzed, summarized, and compiled the result report.

Results

Description of Study Selection

The number of articles obtained from the database used was 7,421 articles. Screening of all articles including titles and abstracts obtained 28 articles. Therefore, after screening based on inclusion, 15 articles were included in this study, of which five were in Indonesian and 10 were in English (Figure 1).

Characteristics of Study

Included studies were articles published from 2014 to 2022, including those published in 2014 (n=1), published in 2015 (n=1), published in 2018 (n=1), published in 2020 (n=3), published in 2021 (n=7), and published in 2022 (n=2). The studies that were included were the experimental study (n=4), quasi-experiment (n=4), randomized control trial (n=6), and case study (n=1). The included studies were conducted in Indonesia (n=5), Turkey (n=4), China (n=2), India (n=2), Iran (n=1), and the United States (n=1). This study's total sample of participants was 1,257 pediatric patients undergoing invasive procedures with an age range of 1–17 years. The Intervention Types analyzed were animated cartoons (n=8), music videos (n=2), and Virtual reality (VR) (n=5). The types of invasive procedures analyzed were infusion (n=3), injection (n=1), blood draw (n=3), surgery (n=3), circumcision (n=2), endoscopy (n=1), phlebotomy (n=1), dressing change (n=1) (Table 1).

Findings of Analysis of Induced Studies

The 15 studies analyzed were 1,257 participants, the majority of which were conducted in Asian countries (95.79%), with experimental study (51.31%) and randomized control trial (40.98%) approaches. The interventions found varied, including the relationship between the type of intervention used and the age of the child undergoing invasive procedures, namely VR used for children 5–17 years (33.65%), animated cartoons in children aged 1–12 years (55.77%), and music videos in children 3–13 years (10.58%). Most audiovisual intervention use was related to the types of invasive procedures found, namely IV insertion (42.09%) and surgery (21.09%). However, other beneficial procedures were Injection, Blood draw, Dressing change, Circumcision, Endoscopy, and Phlebotomy (Table 2).

Overall, based on the analysis of 15 articles, this study shows that three types of audiovisual distraction interventions, namely virtual reality, animated cartoons, and music videos, can help reduce and divert pain in children undergoing

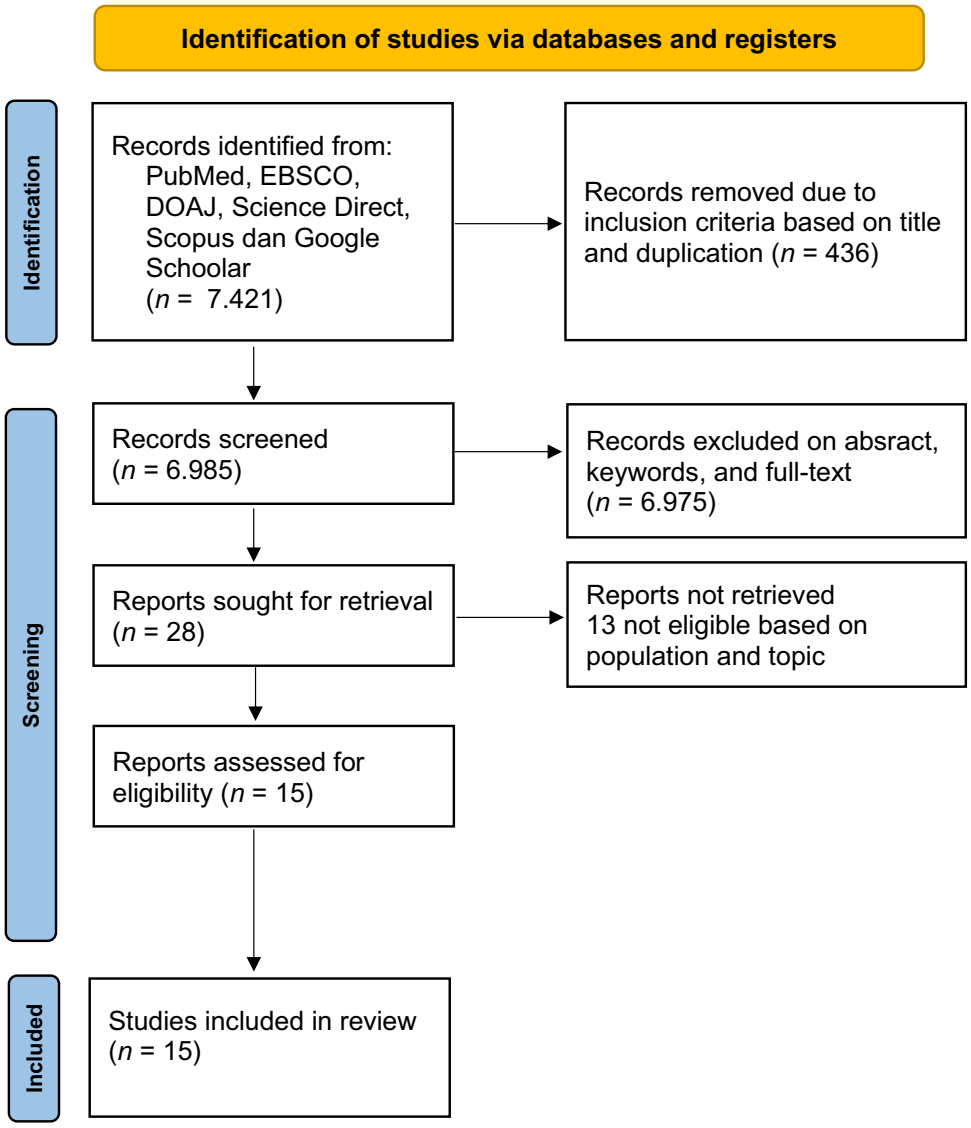

Figure 1 PRISMA Flow diagram. Adapted from Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated: guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. Creative Commons.

invasive procedures.[6,13,30–42] There are also combined audiovisual distractions such as animated videos with VR, a combination of cartoon animated videos with educational animated videos, and a combination of educational animated videos with VR (Table 3).

Table 1 Characteristics of Included Studies (n = 15)

Author	Study design	Country	Intervention Type	Type of invasive procedure	Age (years)	Sample
Sarfika et al (2015)[6]	Quasi Experiment	Indonesia	Animated cartoon	Installation of infusion	2–6	22
Wandini & Resandi (2020)[13]	Quasi Experiment	Indonesia	Animated cartoon	Blood draw	3–6	16
Feng et al (2018)[30]	RCT	China	Animated cartoon	Dressing change	3–7	54
Düzkaya et al (2020)[31]	Experimental Study	Turkey	Animated cartoon	Installation of infusion	6–12	477
Divya & Danieal (2021)[32]	Quasi Experiment	India	Animated cartoon	Blood draw	4–12	40

(*Continued*)

Table 1 (Continued).

Author	Study design	Country	Intervention Type	Type of invasive procedure	Age (years)	Sample
Chavan & Naregal (2021)[33]	Experimental Study	India	Animated cartoon	Blood draw	3–6	60
Buyuk et al (2021)[34]	Experimental Study	Turkey	VR	Circumcision	10	78
Yaz & Yilmaz (2022)[35]	RCT	Turkey	Animated cartoon with VR	Surgery	6–12	132
Rhomantri et al (2022)[36]	Case Studies	Indonesia	Animated cartoon	Injection	1 and 7	2
Liu et al (2020)[37]	RCT	USA	VR	Endoscopy	7–17	53
Kustiningsih et al (2014)[38]	Quasi Experiment	Indonesia	Music videos	Surgery	5–13	17
Inangil et al (2020)[39]	RCT	Turkey	Cartoons with VR	Phlebotomy	7–12	120
Huang et al (2021)[40]	RCT	China	Music videos	Cardiothoracic surgery	3–6	116
Hassannia et al (2021)[41]	RCT	Iran	Circumcision instructional videos and animated cartoons with VR	Circumcision	5–10	40
Ferasinta & Dinata (2021)[42]	Experimental Study	Indonesia	Animated cartoon	Installation of infusion	3–6	30

Abbreviations: Virtual Reality, (VR); Randomized Control Trial, (RCT).

Table 2 Percentage Analysis of Audiovisual Use in Reducing Invasive Pain in Children by Demographic Variables in Selected Studies (n = 15)

Subgroups	Number of studies (N)	Sample size (N)	Percentage (%)
Overall studies	15	1,257	100
Country Regions			
Asian	14	1,204	95.79
Americans	1	53	4.21
Study design			
RCT	6	515	40.98
Quasi Experiment	4	95	7.56
Experimental Study	4	645	51.31
Case Studies	1	2	0.15
Type of intervention related to age (years old)			
Virtual reality (5–17)	5	423	33.65
Animated cartoons (1–12)	8	701	55.77
Music videos (3–13)	2	133	10.58
Type of invasive procedure			
Installation of infusion	3	529	42.09
Injection	1	2	0.15
Blood draw	3	116	9.22
Dressing change	1	54	4.30

(*Continued*)

Table 2 (Continued).

Surgery	3	265	21.09
Circumcision	2	118	9.39
Endoscopy	1	53	4.22
Phlebotomy	1	120	9.54

Abbreviation: Randomized Control Trial, (RCT).

Table 3 Grouping of Audiovisual Distraction Types and Intervention Outcomes to Reduce Pediatric Invasive Procedure Pain (n = 15)

Intervention Type	Authors	Type of invasive procedure	Results
Animated cartoon	Sarfika et al (2015)[6]	Installation of infusion	There was a significant difference in the mean pain scale between children given the distraction technique of watching animated cartoons and children who were not given the distraction technique when an IV was installed with P-value=0.000 (<0.05).
	Wandini & Resandi (2020)[13]	Blood draw	There is a distraction therapy effect of watching cartoon videos in reducing pain in children when taking blood with a p-value of 0.000 (α<0.05).
	Feng et al (2018)[30]	Dressing change	The mean score on the Wong-Baker pain scale in children who were distracted by watching animated cartoons during dressing changes decreased significantly compared to children who did not receive the intervention (P<0.05).
	Düzkaya et al (2020)[31]	Installation of infusion	The average pain score of children who watched informational videos about infusion procedures and watched cartoon videos during infusion procedures was lower than children who did not receive intervention (P<0.01)
	Divya & Danieal (2021)[32]	Blood draw	Animation distraction is effective in reducing the pain response during venipuncture in children with p-value (0.05)
	Chavan & Naregal (2021)[33]	Blood draw	There was a difference between the perception of pain between children who were given cartoon animation video intervention during venipuncture and children who were not given the intervention based on an average pain score of 2.9 ± 0.25 and 2.3 ± 0.46 respectively (p<0.001)
	Rhomantri et al (2022)[36]	Injection	The distraction technique of watching animated cartoons has an influence on reducing the pain scale in children when invasive procedures (injections) are carried out with the FLACC scale (0) after the intervention.
	Ferasinta & Dinata (2021)[42]		The distraction intervention of watching animated cartoons had a significant effect in reducing the pain scale in children during IV installation with p=0.00 (<0.05)
Music video	Kustiningsih et al (2014)[38]	Surgery	There is a significant difference between post-surgical pain after being given audiovisual music therapy with Pvalue=0.000 (< α=0.05)
	Huang et al (2021)[40]	Cardiothoracic surgery	The pain scale based on the WBS and FLACC scales in children who received intervention by watching music videos after cardiothoracic surgery was significantly lower than in children who did not receive video intervention (P<0.05).
Virtual Reality	Buyuk et al (2021)[34]	Circumcision	Post-circumcision WBS (pain intensity) scores were significantly lower in children who were given VR intervention than in children who did not receive the intervention (p<0.001)
	Yaz & Yilmaz (2022)[35]	Surgery	Preoperative fear and postoperative pain scores were significantly lower in children who were given the educational animated film intervention compared to children who did not receive the intervention
	Liu et al (2020)[37]	Endoscopy	There was a significant effect of VR intervention in children undergoing endoscopy in reducing pain (P=0.018)
	Inangil et al (2020)[39]	Phlebotomy	Pain and anxiety in children who underwent phlebotomy with the intervention of watching cartoons using a VR device were lower than children who watched cartoons using a tablet device and children who did not receive the intervention (P<0.05)
	Hassannia et al (2021)[41]	Circumcision	The application of VR for distraction in children significantly reduced pain and anxiety at the beginning of circumcision (P<0.001), during anaesthesia injection (P<0.001), and pain (P=0.005) and anxiety (P<0.001) at the end of circumcision compared with children who do not accept VR distractions.

Abbreviations: Virtual Reality, (VR); Intravenous, IV); Face, Legs, Activity, Cry, Consolability Scale, (FLACC); Wong-Baker FACES, (WBS).

Discussion

This scoping review mainly identifies and categorises audiovisual distraction techniques in reducing pain from invasive procedures among children. Distraction is often referred to as a process of competition between pain sensations and consciously directed attention to some activity that requires information processing.[18] Distraction is classified as internal and external distraction according to the focus of attention. Internal distraction directs attention towards the psychological, ie through deliberate activation of the mind, whereas external distraction directs attention towards environmental stimuli.[20]

Distraction-based techniques offer a variety of options for children undergoing painful medical procedures, providing a comprehensive approach to reduce the experience of pain in children.[19,20] These techniques, including auditory, visual, and cognitive distraction, offer a range of options. Popular distractions often used in pain experiences include watching videos, listening to music, and imagination.[18,20]

Based on the study results from the 15 articles we analyzed, most studies showed that audiovisual techniques can help distract pain in children undergoing invasive procedures, namely music videos, animated cartoons, and VR.

Music Videos

Distraction using music videos is a therapy that involves hearing and seeing sounds/audio accompanied by music videos.[38] Compared to using music therapy alone, music video distraction will be closer to life and the characteristics of children's imagination.[40,43] Our findings highlight that audiovisual distraction with video music can be given to children between the ages of 3 and 13.[38,40] Based on the analysis of both articles, the two types of music used for pain distraction in children are children's pop song music videos and animated music videos.

Music video distraction can distract children from the pain of invasive procedures. Previous studies revealed that video music distraction can help reduce children's pain sensitivity and stabilize heart rate, blood pressure and respiratory rate due to invasive procedures.[40] Music video distraction can be used as one complementary therapy for analgesic administration in reducing pain levels in children due to invasive procedures.[38] Video music is also easy to operate, safe, effective, well received by children and feasible for clinical applications.[40]

Animated Cartoons

Audiovisual using cartoon animation videos is a distraction that is used to distract children from their pain by watching cartoon animation videos.[13] Cartoon animation videos are relatively simple and quick to distract and prepare children for invasive procedures.[31]

Our findings show that cartoon video distraction can be given to children aged 1 to 12 years.[31–33,35,36,39,41,42] Various benefits can be obtained from the distraction technique of watching cartoon animation videos, including distracting attention from the pain felt by the child, eliminating the child's concentration on pain stimulation, reducing fear, reducing anxiety, children can undergo invasive procedures calmly and minimize the occurrence of trauma.[6,13,30,33]

Virtual Reality

Virtual reality is a device that shows visuals from various angles or 3-dimensional (3D) visuals so that individuals who use it can interact with something simulated by a computer.[44,45] Distraction techniques with VR are one of the techniques that can be used for pain management due to invasive procedures on children.[37,41] The use of VR can help children relax before undergoing invasive procedures. As well as reduce children's pain, anxiety and fear due to invasive procedures.[34]

Distraction using VR can be used in children who are in the age range of 5 to 17 years. In studies by Hassania et al, this VR distraction can be used in various fields of nursing, including clinical services and training for nurses working in surgical and pediatric wards.[41] In addition, in studies by Liu et al, the use of distraction with VR can also increase invasive procedural satisfaction among children.[34,37]

Strength and Limitations

This study has limitations. Accessing some articles in full text is limited, so it is possible that there is still literature that needs to be included from other databases, which causes incomplete literature. In addition, it does not apply article quality assessment to minimize restrictions on included articles. However, despite the limitations, some advantages of this study must also be recognized. This study was a scoping review that identified literature on audiovisual techniques in reducing pain in children undergoing invasive procedures worldwide. The study covered various countries in the Americas and Asia. However, the findings from this study represent two regions of the world that can be used to inform health services and governments to develop strategic policies and interventions to address the problem of pediatric pain due to invasive procedures.

Conclusion

Based on the results of this systematic scoping review, 15 articles describe the audiovisual distraction technique for reducing pain in children undergoing invasive procedures. Our study identified three types of audiovisual interventions: virtual reality (VR), video music, and animated cartoons. In addition, we found several types of invasive procedures that benefited from the three interventions analyzed: IV insertion, surgery, injection, blood draw, dressing change, circumcision, endoscopy, and phlebotomy.

The implications of our study findings indicate the potential of audiovisual interventions to help reduce pain in children undergoing various invasive procedures during hospitalization. This study can be an additional foundation for health services and nurses in considering safe interventions for children, especially pediatric nurses in determining pain intervention strategies in children undergoing invasive procedures. However, further research with a meta-analysis approach is needed to find out more detailed results. In addition, this study can also be used as additional information for further research in this area.

Acknowledgments

The authors thank the Universitas Padjadjaran, Bandung, Indonesia, for supporting and facilitating the database search.

Disclosure

The authors declare no conflicts of interest in this work.

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