

# Effectiveness of Distraction Cards in Reducing Pain During Peripheral Intravenous Cannulation in School-Age Children: A Randomised Controlled Trial

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## ABSTRACT

**Background:** Following ethical and legal professional obligations, nurses should use evidence-based methods to enhance the patient experience during intravenous cannulation. Non-pharmacological pain management techniques are now used in the clinical setting and can be performed without additional cost or time. Therefore, this study targets alleviating pain during intravenous cannulation procedures. **Objectives:** To investigate the effects of distraction cards in reducing peripheral intravenous cannulation-related pain among school age children. **Methods:** A comparative and prospective randomised controlled trial was employed. The study was carried out on 148 school-age children who had Peripheral Intravenous Cannulation (PIVC). Patients were divided into two groups randomly: the Distraction Cards group (n = 71) and the control group (n = 77). Immediately after the PIVC procedure, the patients were asked to rate their level of pain by using the Wong-Baker Faces Pain Scale. **Results:** Pain intensity was significantly lower in the Distraction Cards group compared to the control group ( $p < 0.001$ ), with a mean difference of 2.27. Conversely, the control group exhibited moderately higher pain scores (mean difference = 3.23) relative to the Distraction Cards group. **Conclusion:** Distraction cards are effective in relieving pain during IV cannulation. Similar experimental studies in larger children community samples are recommended to provide stronger evidence of their effectiveness.

**Keywords:** *Distraction Cards; Intravenous Cannulation; Pain Management*

## INTRODUCTION

Despite advancements in paediatric healthcare, procedural pain remains a significant challenge for children, particularly during intravenous cannulation. The way a kid perceives pain is influenced by a variety of factors, including their age, developmental stage, cognitive capacity, communication style, past experiences with pain, and pain beliefs. Adverse events resulting in chronic, severe pain might lead to physiological and behavioural issues. If the pain is not reduced or completely resolved at this time by appropriate treatments, it may lead to long-term neurological and behavioural problems (Semerci, Akarsu & Kılıç, 2023). For more than three decades, the significance of treating children's pain has been well acknowledged. Because of the immaturity of their neural systems, it was formerly believed that new-borns and early children could not feel pain or remember painful events. However, nowadays, there is a wealth of research that supports the detrimental and long-term effects of pain (Nemat-Shahi *et al.*, 2020).

Each year, approximately 1.2 billion peripheral intravenous catheters are globally inserted. It is widely acknowledged that this procedure can cause pain, which in turn can negatively affect cognitive function due to the ensuing discomfort and anxiety (Rodriguez *et al.*, 2020). Healthcare professionals have a responsibility to ensure that every patient receives the most suitable infusion therapy using the most appropriate device and site, in the most suitable environment and at the correct time (Yilmaz, Yilmaz & Karaman, 2023).

Children frequently experience pain during medical procedures involving the use of needles, such as blood samples, intravenous catheter placement, intramuscular injections, and immunisations. Both children and their parents may experience intense levels of stress, fear, and anxiety as a result. In addition, children's fear and

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anxiety following these medical procedures can last until puberty (Karbandi *et al.*, 2020). The most common cause of procedure-related pain in children is self-reported as Peripheral Intravenous Cannulation (PIVC) insertion in hospitals (Indarwati, Munday & Keogh, 2022). For both children and adults, getting poked by a needle is one of the most dreaded medical experiences. According to research, children who frequently encounter pain exhibit altered pain perception, increased pain sensitivity, and inappropriate pain responses. (Sayed, Mohamed & Abolwafa, 2020). According to estimates, between 30% to 80% percent of hospitalised patients who are admitted need PIVC.

The World Health Organization (WHO) and paediatric medical associations emphasise the importance of improving approaches to managing pain and anxiety in children within medical settings, including emergency care. Intravenous procedures are among the most painful interventions in paediatric medicine Majeed *et al.*, 2023). The most commonly self-reported cause of procedure-related pain in children is peripheral intravenous catheter (PIVC) insertion in hospitals (Mendes, Furlan & Sanches, 2022; Indarwati, Munday & Keogh, 2022). Effective pain control is a crucial aspect of quality care and has been designated the fifth vital sign by the American Pain Association (Abdul-Hussein & Hattab, 2022). Providing appropriate pain management is recommended to prevent future negative consequences from painful procedures. By improving adherence to medical care and reducing avoidance behaviours, managing procedural fear may offer both short- and long-term benefits (İnangil, Şendir & Büyükyılmaz, 2020). Nurses are encouraged to employ strategies that minimise the fear, pain, and anxiety typically associated with venepuncture procedures to reduce patient discomfort (Welyczko, 2020). Distraction is one of the most effective non-pharmacological methods for alleviating anxiety and pain in children during medical procedures. It is based on the principle that redirecting a child's attention to engaging stimuli can reduce their perception of pain, especially given their limited coping capacity. This technique is widely used by healthcare professionals and parents to manage procedural distress in children (Gerards *et al.*, 2025; Balliel, 2023; Besirik & Sahiner, 2024; Sivri *et al.*, 2023). The analgesic effect of distraction is grounded in the theory that the brain has a limited capacity to process multiple stimuli simultaneously. Redirecting attention toward non-painful stimuli—such as visual or auditory cues—significantly reduces the perception of pain (Sari *et al.*, 2025; Asefi & Wippert, 2024). Various distraction techniques have been explored, including the use of distraction cards and the Buzzy device (Sivri *et al.*, 2023; Yıldırım & Gerçeker, 2023). Beyond pain reduction, distraction also positively impacts mood by stimulating the release of anti-stress hormones, promoting mental relaxation (Örün, Karaca & Arıkan, 2021). This dual effect—both physical and psychological—makes distraction a holistic approach for managing procedural distress in children (Shen *et al.*, 2023). These findings justify the current study, which aims to address existing research gaps while generating evidence-based recommendations for paediatric nurses involved in PIVC procedures. The present study specifically aims to investigate the efficacy of distraction cards in reducing PIVC-related pain in school-aged children.

## METHODOLOGY

### Study Design

This study used a prospective randomised controlled trial Sivri, Balci & Dolgun (2023). The researchers have used to evaluate the effectiveness of distraction cards in reducing pain associated with peripheral venous catheters among school-age children.

### Sample and Sampling

The study was conducted at a paediatric hospital in Mosul City, which is the only specialised hospital for paediatric care. Participants were randomly assigned to groups using a lottery method to minimise selection bias. The researcher wrote the codes for the two groups—'C' for the Control group and 'D' for the Distraction Cards group—on separate pieces of paper, which were then placed inside a container. To ensure blinding, participating children randomly selected a paper from the container, each containing the code for one of the groups. A total of 148 patients with a documented order for intravenous cannulation were systematically targeted after a thorough examination by the emergency department (ED) physician. The sample was divided into 71 children in the Distraction Cards group and 77 children in the Control group. A-priori sample size calculations for t-tests were used to determine the minimum required sample size, as presented in Table 1. The response rate was approximately 91%.

## Sample Size Calculation

The minimum sample size for the study was determined through a literature review (Naser & Al-Fayyadh, 2024). The sample comprised (148) school-age children's patients. These patients were divided into two groups, distraction cards and control group. The minimum sample sizes were calculated using a priori sample sizes for student *t*-tests as in Table 1.

**Table 1: Minimum Sample Size Determination**

The Parameter of Calculation the Minimum Sample Size	Selected Values
Anticipated effect size (Cohen's <i>d</i> ):	0.5
Desired statistical power level:	0.8
Probability level:	0.05

- Minimum sample size per group (one-tailed hypothesis): 51
- Minimum total sample size (two-tailed hypothesis): 128
- Minimum sample size per group (two-tailed hypothesis): 64

## Inclusion Criteria

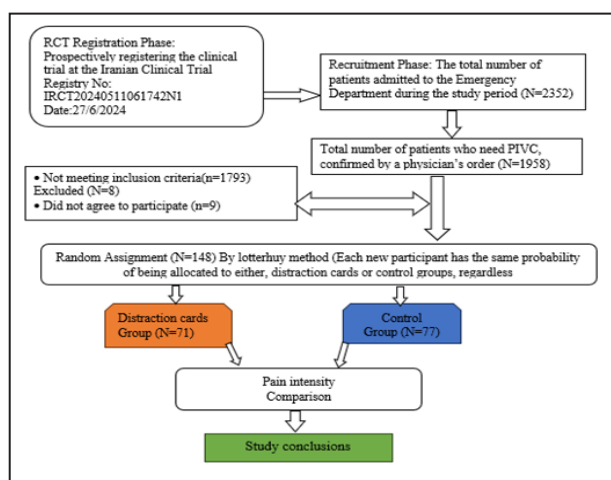
Guardians of subjects aged 6 to 12 who agreed to volunteer for study. Having undamaged hand skin does not have a life-threatening disease, while the intravenous cannula was introduced solely to the right and left hands. No difficulties in communication, including hearing, vision, and speech, that may significantly influence the quality of the gathered data and the progress of the study owing to the difficulty of establishing good communication and mutual understanding.

## Exclusion Criteria

Included those with significant local infection or cellulitis at the planned IV cannula insertion site, as well as those with skin problems such as burns, rashes, open wounds, abscesses, or boils. These circumstances might affect the intended course of therapy, raise the risk of infection exacerbate the disease, and affect how well the intravenous cannulation is inserted.

## Intervention

A single emergency department nurse with 12 years of experience performed all cannulations to ensure procedural consistency. Prior to catheter insertion, the researcher introduced the distraction cards, which included interactive puzzles, mazes, and 'spot the difference' scenes featuring vibrant, child-friendly themes (e.g., animals, puzzles). The child was instructed to focus on solving these tasks starting after skin sterilisation and continuing throughout the procedure. To sustain engagement, the researcher encouraged the child to verbalise their progress (e.g., How many differences have you found so far?). Parental or nursing interventions were prohibited to ensure consistency. Immediately post-procedure, pain intensity was assessed using the Wong-Baker FACES scale.



**Figure 1: Study Algorithm**

This figure illustrates the recruitment of eligible participants, random assignment into either the Distraction Cards group or the Control group using a lottery method, the intervention process involving distraction cards during PIVC, and post-procedure pain assessment using the Wong-Baker FACES Pain Rating Scale (Figure 1).

### Data Collection Tool(s) Blinding

The description of blinding is an important standard for ensuring strong methodological quality, particularly in relation to the internal validity of a Randomised Controlled Trial. In this trial, a single-blind technique was used, referring to the process of concealing certain information from participants (Monaghan *et al.*, 2021).

The instrument used in the study consisted of two parts. Part 1 covered sociodemographic characteristics, including age, gender, place of residence, order of birth, relation of the guardian (father, mother, or another person), and the educational level of the parents. Part 2 focused on medical information about the child, involving questions such as the reason for admission, site of venous access, previous venepuncture within the last three months, PIVC size, site of venepuncture, and the Wong-Baker FACES Pain Rating Scale.

### Wong-Baker FACES Pain Rating Scale

The most widely used technique for evaluating children's pain is self-report scales. Self-report measures are dependent on the noxious stimuli's sensory, emotional, and contextual characteristics (Kamki, Kalaskar & Balasubramanian, 2022). The researcher obtained official approval to use the WBP scale from the concerned authority. Wong-Baker FACES The Pain Measure is the most often used and recognised self-report pain scale for children. To determine the efficacy of distraction cards the Wong-Baker FACES® Pain Rating Scale was used. Six face photos make up this scale. Every image has a number assigned to it, ranging from 0 to 10, with 0 denoting "no hurt" and 10 denoting "hurts worst." After being shown this scale, the patient was instructed to choose the picture that most closely matched their present level of pain (Garra *et al.*, 2013).

### Data Analyses

Descriptive statistics: frequency, percentage, mean, and standard deviation, were used to analyse the demographic data. The paired independent t-test was used to compare Means and SD in the two groups. ANOVA test was used to find the association between demographic variables and the pain level of a control group. The significance level was set at  $p < 0.01$  in all the tests. The statistical analyses were conducted by SPSS version 26.

### Ethical Consideration

The researchers obtained ethical clearance from the Ethics Committee of the College of Nursing University of Baghdad, Iraq with reference number 1608 on 25<sup>th</sup> April 2024.

## RESULTS

**Table 2: Distributions of Participants' Sociodemographic Characteristics**

Variables			Group		Total	$\chi^2$	p-value
			Distraction Cards	Control			
Age of Children	6-8 years	Count	38	46	84	0.62	0.73
		% of Total	25.7%	31.1%	56.8%		
	9-10 years	Count	19	17	36		
		% of Total	12.8%	11.5%	24.3%		
	11-12 years	Count	14	14	28		
		% of Total	9.5%	9.5%	18.9%		
Total		Count	71	77	148		
		% of Total	48.0%	52.0%	100.0%		
Sex of Children	Male	Count	33	42	75	1.29	0.256
		% of Total	22.3%	28.4%	50.7%		
	Female	Count	38	35	73		
		% of Total	25.7%	23.6%	49.3		
Total		Count	71	77	148		
		% of Total	48.0%	52.0%	100.0%		

Order of Birth	First	Count	13	22	35	3.14	0.534
		% of Total	8.8%	14.9%	23.6%		
	Second	Count	16	21	37		
		% of Total	10.8%	14.2%	25.0%		
	Third	Count	19	14	33		
		% of Total	12.8%	9.5%	22.3%		
	Forth	Count	14	14	28		
		% of Total	9.5%	9.5%	18.9%		
	More than 4	Count	9	6	15		
		% of Total	6.1%	4.1%	10.1%		
Total		Count	71	77	148		
		% of Total	48.0%	52.0%	100.0%		
Residency	Urban	Count	45	54	99	0.75	0.386
		% of Total	30.4%	36.5%	66.9%		
	Rural	Count	26	23	49		
		% of Total	17.6%	15.5%	33.1%		
Total		Count	71	77	148		
		% of Total	48.0%	52.0%	100.0%		
Relation of the guardian	Father	Count	12	7	19	0.02	0.999
		% of Total	8.1%	4.7%	12.8%		
	Mother	Count	7	12	19		
		% of Total	4.7%	8.1%	12.8%		
	Both parent	Count	44	49	93		
		% of Total	29.7%	33.1%	62.8%		
	Other	Count	8	9	17		
		% of Total	5.4%	6.1%	11.5%		
Total		Count	71	77	148		
		% of Total	48.0%	52.0%	100.0%		

% of Total 48.0% 52.0% 100.0% No: Number, %: Percentage

Table 2 shows that 56.8% of the participants were in the 6–8 age group, followed by the 9–10 age group (24.3%) and the 11–12 age group (18.9%). According to the sex breakdown, 5.7% of the children were female and 49.3% of them were male. According to the birth order, the percentages were almost equal: first born (23%), followed by second born (25%), third born (22.6%), and fourth born (10%) in terms of birth order. According to the residency statistics, 33% of the children lived in rural regions, whilst 66% of them lived in urban areas. Finally, concerning the child's relation to the guardian, the highest percentage was both parents (62%), and the other percentages were almost equal.

**Table 3: Description of Children's Medical Data**

Variables		Frequency	%	$\chi^2$	p-value
<b>Site Of Canulation</b>	Hand	93	62.8	1.12	0.57
	Antecubital fossa	37	25.0		
	Forearm	18	12.2		
	Total	148	100.0		
<b>Canula Size</b>	24 g	77	52.0	0.52	0.47
	22 g	71	48.0		
	Total	148	100.0		
<b>Cause Of Admission</b>	Respiratory problems	23	15.5	4.13	0.39
	Gastrointestinal problems	45	30.4		
	UTI problems	15	10.1		
	Fever	19	12.8		
	Others	46	31.1		
	Total	148	100.0		
<b>Previous Cannulation</b>	Yes	40	27.0	0.98	0.32
	No	108	73.0		
	Total	148	100.0		

F= Frequency, %= percentage

Table 3, shows the hand was the cannulation site in the majority of children (62.8%), followed by the antecubital fossa (25.0%) and the forearm (12.2%). Furthermore, 24g (52.0%) was the most often utilised cannula



size, with 22 g (48.0%) coming in second. The majority of children were hospitalised for gastrointestinal disorders (30.4%), followed by respiratory difficulties (15.5%), fever (12.8%), urinary tract infections (10.1%), and miscellaneous illnesses (31.1%). In addition, 27.0% of the children had previously received cannulation, but a sizable number (73.0%) had never had it.

**Table 4: Pain Level According to Types of Group**

Pain Intensity	Distraction Cards Group		Control Group	
	No.	%	No.	%
No Pain	10	14.1	0	0.0
Mild Pain	32	45.0	4	5.2
Moderate Pain	29	40.8	28	36.4
Severe Pain	0	0.0	30	38.9
Very Severe Pain	0	0.0	15	19.5
<b>Total</b>	<b>71</b>	<b>100</b>	<b>77</b>	<b>100</b>

No: Number, %: Percentage

Table 4 shows that in the distraction cards group, 14.1% of children reported no pain, 45.1% reported a little pain, and 40.8% reported a little more pain. According to Table 4, which shows pain levels by group type. The control group, on the other hand, had no children reporting no discomfort, just 5.2% reporting a little pain, 36.4% reporting a little more pain, 38.9% reporting considerably more pain, and 19.5% reporting a lot of pain.

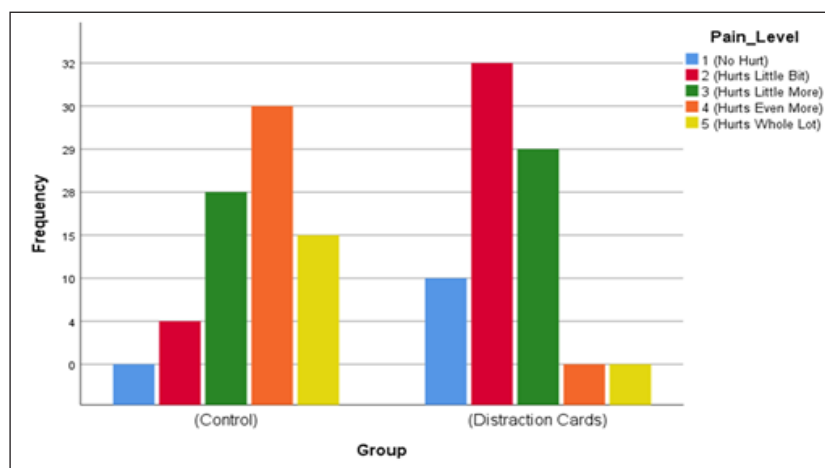
**Table 5: One Way ANOVA: Differences in Pain Intensity between Distraction Cards and Control Group**

Source of Variation	Sum of Squares	df	Mean Square	F	p-value (Sig.)
<b>Between Groups</b>	78.704	1	78.704	131.792	0.000 <sup>*</sup>
<b>Within Groups</b>	87.188	146	0.597		
<b>Total</b>	165.892	147			

Note: df: Degree of freedom; \* $p < 0.001$  indicates statistical significance

The results of the one-way ANOVA (Table 5) demonstrate a statistically significant difference in pain intensity between the Distraction Cards group and the Control group  $F(1, 146) = 131.792, p < 0.001$ . The intervention group exhibited significantly lower mean pain scores compared to the control group, with a mean difference of 2.27 and a 95% Confidence Interval (CI) ranging from 2.02 to 2.52. This indicates that the distraction card technique was highly effective in reducing perceived pain intensity among children during the procedure.

This study demonstrated a statistically significant reduction in pain intensity among children using distraction cards during peripheral intravenous cannulation (PIVC), with a mean difference of 2.27 (95% CI: 2.02–2.52;  $p < 0.001$ ) As illustrated in (Table 4). The majority of participants were aged 6–8 years, with balanced gender distribution and urban residency. Most children had no prior cannulation history, and gastrointestinal issues were the leading cause of hospitalisation. Pain scores in the distraction group were markedly lower, with 14.1% reporting "no pain" compared to 0% in the control group.



**Figure 2: Pain Levels between the Intervention and Control Groups**

Furthermore, it also has a positive effect on the mood leading to the release of anti-stress hormones and eventually mental relaxation (Örün, Karaca & Arıkan, 2021). As illustrated in Figure 2 the current study included 148 samples of children collected from Ibn Al-Atheer Teaching Hospital for Children, which covered Nineveh Governorate and neighbouring cities.

## DISCUSSION

The present study aimed to evaluate the effectiveness of distraction cards in reducing pain during Peripheral Intravenous Cannulation (PIVC) in school-age children, and the findings provide compelling evidence supporting their use as a non-pharmacological intervention in paediatric settings. Distraction techniques are simple and effective methods to divert children's attention away from painful stimulus to reduce anxiety. Attracting attention to more pleasant stimulus can considerably reduce anxiety, fear, and pain (Balliel, 2023).

The most common age group visiting the emergency department was (6-8) years. The male and female genders are equal in number with a slight difference, and the equality of the sample between the two genders may be due to the similarity of the statistics for both males and females. This result is consistent with another study (Obaid *et al.*, 2020) and according to another study, it showed that (50%) of the study sample is in the age group (6-7) years, and (60%) of them are males (Al-Musawi *et al.*, 2020; Thbeet & Shoaq, 2022). The results of the current study showed that city residents constituted a large proportion of the total sample size, amounting to about 70%, and the proportion of rural reviewers was about 30%. This result is consistent with previous studies that confirmed that urban areas constituted the majority of their study (Kalel & Shawq, 2023). As for the birth order in the family, the percentages were almost equal for the birth order: first, second and third (19%), these results disagree with another study in Iraq (Shawq & AL-Mousawi, 2020). Regarding the relation of the guardian during the PIVC procedure, the largest percentage was both parents in both groups, almost equally, 63%. This percentage does disagree with another study, where the mother was the primary guardian during the procedure (Sivri *et al.*, 2023).

Regarding the site of cannulation, the result agrees with a similar study, where the highest percentage 69% of cannula sites is in the hand (van Loon *et al.*, 2022). According to the size of the PIVC used, the percentage was almost equal between size 24 and 22, at 42% and 58%. This percentage may agree with a study conducted in Turkey, where the percentage was 54% for cannula size G24 (Yıldırım & Gerçeker, 2023). The study shows different of child's causes of hospital admission The percentage of causes related to the digestive system and other reasons was the highest. The results do not agree with another study conducted in Iraq, where the highest percentage of the reason for admission was respiratory infection, at the highest percentage, 33%. Furthermore, none of the children in either of the two groups had received a PIVC in the last three months. This implies that the children of the research participants were either generally healthy before the study or had little exposure to nursing procedures, The results of the study are consistent with the results of another study conducted in Iraq, where most of the participants, 75%, also had no history of cannulation during the last 3 months (AL-Shammiry & AL-Fayyadh, 2024).

The findings align with previous research indicating that distraction-based interventions can effectively reduce procedural pain in children (Besirik & Sahiner, 2024; Erdogan & Ozdemir, 2021). As illustrated in Figure 2 and the data presented in Table 3 indicate that participants in the "Distraction card group" exhibited lower pain scores compared to the control group, highlighting the statistical differences in pain levels based on the experimental group type. Needle related techniques can be less painful if they are backed by the gate control theory. According to this idea, the spinal cord, where a process known as neural gating takes place, is where pain is controlled in the central nervous system (Uma & Clement, 2020). The neural gate regulates how pain impulses are sent from the nerves to the brain. The idea behind this theory is that pain can be reduced by focusing on non-painful nerve signals that affect the neural gate's closure. As a result, these processes provide little discomfort when the needle punctures the skin (Hao *et al.*, 2023). Few RCTs investigate the effect of Distraction cards on venepuncture pain in children of similar age groups. This study confirmed the results of those studies on the use of cards to reduce pain, as they all confirmed the effectiveness of this method in reducing pain in children during needle-related procedures (Besirik & Sahiner, 2024; Erdogan & Ozdemir, 2021).

Present findings indicate that there was a highly significant difference between distraction cards and control groups regarding the use of distraction cards for decreasing the children's pain level during the PIVC

procedure. This agrees with other studies that used distraction cards and found them active in reducing needle-related pain (Erdogan & Ozdemir, 2021; Fadhil & Ali, 2019).

### Limitation

As the study is new and the first of its kind in Iraq, there were some challenges in carrying it out. Such situations include, but are not restricted to, the following. The fact that this study was carried out in the Ibn-Alatheer Paediatric Hospital in Mosul, Iraq, may restrict how broadly the findings may be applied. As the emergency wards are intended for emergency situations, (RCTs) are difficult to apply and the crying of some other children may have harmed the children participating in the study while they were waiting in the same room for the PIVC. Additionally, getting a sample during the morning shift is challenging and complicated due to the existence of early consultation clinics. Lastly, additional variables including anxiety levels and prior experiences could also affect the pain felt during PIVC.

### CONCLUSION

This preliminary study on the use of distraction cards found that their use resulted in a significant reduction in pain in children undergoing PIVC, in contrast to the results of the control group. As a result, it may be suggested that health professionals in Iraq incorporate non-pharmacological pain management into painful nursing procedures. Essentially, it emphasises the importance of implementing effective pain reduction methods, especially those that are non-pharmacological and innovative, to enhance the patient experience during intravenous cannulation. Nurses should receive training in this field. Future research should explore the long-term effects of distraction techniques and compare different non-pharmacological pain management strategies in diverse clinical settings.

### Conflict of Interest

The authors declare that they have no competing interests.

### ACKNOWLEDGEMENT

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