JKM
Sai Wawai

Jurnal Kesehatan Metro Sai Wawai
Vol. 19, No. 1, June 2026. DOI: https://doi.org/10.26630/jkmsw.v19i1.5726
Journal homepage https://ejurnal.poltekkes-tjk.ac.id/index.php/JKM
E-mail: jkm@poltekkes-tjk.ac.id

ISSN Online
2657-1390
ISSN Print
19779-469X

Implementation of Audiovisual Distraction Intervention Using a Playmate Music Set to Reduce Infant Pain Response During Immunization: A Case Study

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ARTICLE INFO

Article history

Submitted: 21 May 2026

Revised: 7 June 2026

Accepted: 22 June 2026

Keywords:

Children, Distraction audiovisual, Immunization, Nonpharmacological therapy

ABSTRACT

Immunization is an essential preventive measure for protecting infants and children from infectious diseases and reducing morbidity and mortality. However, immunization procedures often cause pain, fear, and distress due to needle insertion, which may negatively affect the experiences of both infants and parents and potentially influence adherence to future immunization schedules. Therefore, practical non-pharmacological interventions are needed to support infant comfort during immunization procedures. This study aimed to explore the use of audiovisual distraction using a playmate music set during infant immunization in a primary healthcare setting. A case study design was employed involving two six-month-old infants with similar demographic characteristics. One infant received audiovisual distraction using a playmate music set before and during immunization, while the other underwent routine immunization without distraction. Pain responses were assessed immediately after immunization using the FLACC (Face, Legs, Activity, Cry, and Consolability) scale. The infant who received the audiovisual distraction intervention demonstrated a lower FLACC score than the infant who did not receive the intervention (5 vs. 10). The intervention case also appeared calmer during the procedure, cried for a shorter duration, and was easier to soothe following vaccine administration. Preliminary findings from this case study suggest that audiovisual distraction using a playmate music set may help reduce observable pain responses and discomfort during infant immunization. As a simple, safe, and practical intervention, it has the potential to support atraumatic immunization practices in primary healthcare settings. However, given the limited number of cases, further studies with larger sample sizes and more rigorous research designs are required to confirm these findings.

INTRODUCTION

Immunization is one of the most effective public health interventions for preventing infectious diseases and reducing child morbidity and mortality worldwide (Dixon MG, 2020; Kementerian Kesehatan, 2024; Minta et al., 2024). By stimulating the immune system to produce specific antibodies, immunization enables the body to recognize and combat infectious agents more effectively (Machingaidze & Wiysonge, 2021). Routine infant immunization has substantially reduced the incidence of vaccine-preventable diseases, including measles, diphtheria, pertussis, hepatitis B, and poliomyelitis (Lubeya et al., 2023). In addition to providing direct protection to vaccinated individuals, high immunization coverage contributes to herd immunity, thereby reducing disease transmission within communities (Insani & Prakoso, 2022).

Despite its benefits, immunization procedures are frequently associated with pain, fear, and distress in infants and children because they involve needle insertion and tissue injury (Chang et al., 2022). According to the International Association for the Study of Pain (2021), pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage.

In infants, pain responses are commonly manifested through crying, facial grimacing, increased motor activity, physiological instability, and difficulty being consoled (Peng et al., 2023). Repeated painful experiences that are inadequately managed may contribute to heightened procedural anxiety, fear of healthcare interventions, and reduced compliance with future immunization schedules (Sarah et al., 2023; Wang et al., 2022). Furthermore, these distressing experiences may also affect parents and caregivers, whose emotional responses can influence a child's coping ability during medical procedures. Family support, as a form of interpersonal relationship that protects individuals from stress, plays an important role in helping children feel secure and supported during potentially painful healthcare experiences (Heltty, 2022). Therefore, interventions aimed at reducing pain and distress during immunization may benefit not only infants but also their families by promoting a more positive immunization experience.

Concerns related to pain and distress during immunization may also influence parental attitudes toward vaccination. Globally, approximately 14.3 million children were classified as "zero-dose" children in 2022, meaning they had not received any routine vaccinations. In Indonesia, 1,879,820 children were reported to have incomplete immunization status between 2018 and 2023 (Kementerian Kesehatan, 2024). Complete immunization is essential for achieving optimal immune protection in infants, as full vaccination schedules provide more effective protection against various infectious diseases than incomplete immunization (Supriani et al., 2022). However, despite the well-established benefits of immunization, coverage remains suboptimal in many settings. Although multiple factors contribute to incomplete immunization, including limited access to healthcare and inadequate parental knowledge, negative experiences associated with immunization procedures, such as pain and distress, remain important concerns that may influence parental willingness to complete recommended vaccination schedules (Machingaidze & Wiysonge, 2021). Therefore, effective pain-management strategies are needed to improve children's comfort and support positive immunization experiences, including providing interventions that can reduce pain and discomfort in children during immunization procedures to increase immunization compliance

Non-pharmacological interventions have gained increasing attention because they are safe, practical, and easily integrated into routine immunization services. Among these approaches, audiovisual distraction has demonstrated effectiveness in reducing procedural pain, anxiety, and distress in pediatric populations (Bajaj et al., 2025; Goktas & Dilek, 2023; Shen et al., 2023; Yantie et al., 2023). Audiovisual distraction works by directing a child's attention away from painful stimuli toward engaging sensory inputs, thereby modifying pain perception and reducing emotional distress during invasive procedures (Shen et al., 2023).

Recent evidence indicates that audiovisual distraction can reduce pain responses during various pediatric procedures, including vaccination, venipuncture, blood sampling, and intravenous cannulation. However, most studies have evaluated interventions such as virtual reality devices, animated videos, tablets, smartphones, or digital music applications among hospitalized children and older pediatric age groups (Ramdhanie et al., 2024). Consequently, evidence regarding audiovisual distraction specifically designed for infants undergoing routine immunization remains limited.

One potentially applicable intervention is the playmate music set, a playmat-based audiovisual device that combines visual stimulation, interactive sensory elements, and music in a single infant-friendly medium. Unlike virtual reality systems or screen-based audiovisual interventions that require active visual attention and are generally intended for older children, the playmate music set is designed to match infants' developmental capabilities by providing continuous multisensory stimulation while the infant remains in a comfortable position during immunization. This characteristic may make the intervention more feasible for use in primary healthcare settings and community-based immunization services.

Although audiovisual distraction has been widely studied, research examining the effectiveness of playmate music set-based audiovisual stimulation during routine infant immunization is still scarce, particularly among six-month-old infants in primary healthcare settings. Existing studies have predominantly focused on hospital-based procedures, older pediatric populations, or technology-intensive interventions that may not be readily available in

community health services. To date, evidence regarding the application of a playmate music set during routine infant immunization in Indonesian primary healthcare settings remains limited.

Therefore, this case study aims to explore the implementation of audiovisual distraction using a playmate music set and its potential role in reducing pain responses during immunization among six-month-old infants in a primary healthcare setting. The novelty of this study lies in the application of a developmentally appropriate, low-cost, and easily implementable audiovisual intervention specifically designed for infants receiving routine immunization in community-based healthcare services. The findings are expected to contribute to the development of practical atraumatic nursing interventions that can enhance infant comfort and support positive immunization experiences.

METHOD

This study used a case study design. Two groups of respondents participated: one group of infants received an audiovisual distraction intervention using a music playmate set during the immunization procedure, while the other group did not receive this intervention. An audiovisual distraction intervention was implemented by providing sound and music stimuli from Playmate media to help divert infants' attention during immunization. This study was conducted in November 2025 in the Pakis District.

This case study did not undergo a separate ethical review process because it was conducted within the framework of an established collaboration between the university and the community health post (Posyandu). The intervention consisted of a non-invasive audiovisual distraction technique and did not alter the standard immunization procedures provided by healthcare personnel. Informed consent was obtained from the infants' parents or legal guardians prior to participation, and all collected data were treated confidentially and used solely for academic and research purposes.

The respondents in this study were two 6-month-old infants with similar demographic characteristics, referred to as Baby A, who received the audiovisual distraction intervention using a playmate music set during immunization, and Baby C, who underwent the immunization procedure without the intervention.

The inclusion criteria for this study were as follows: (Bajaj et al., 2025).

1. Infants aged 6 months.
2. Infants of the same sex.
3. Infants in good general health and not experiencing fever or acute illness at the time of immunization.
4. Parents or legal guardians willing to allow the infant to participate in the study and provide informed consent.
5. Infants with comparable demographic characteristics, including age/date of birth, sex, type of immunization administered, and health condition prior to immunization.

The exclusion criteria for this study were as follows:

1. Infants with a history of hearing impairment or neurological disorders.
2. Infants receiving analgesic or sedative medications prior to immunization.
3. Infants who were excessively fussy or crying before the immunization procedure began.
4. Infants who experienced complications or emergency conditions during the immunization process.
5. Parents or legal guardians who were unwilling to continue participation in the study

The research instrument used was an observation sheet in the form of an FLACC (Face, Legs, Activity, Cry, Consolability) scale checklist to measure pain responses in infants during the immunization procedure. The FLACC scale is used through observations of five indicators: facial expression, leg movement, activity, crying, and consolability. Each indicator is given a score of 0–2, so the total score ranges from 0–10, where a higher score indicates a more severe level of pain. This instrument was chosen because it has good validity and reliability in assessing pain in infants and children who are not yet able to express pain verbally (Crellin et al., 2021). In addition, the FLACC scale is considered sensitive and effective for measuring procedural pain in infants and

young children in various invasive procedures (Arabiat et al., 2023).

As a first step in data collection, researchers conducted an assessment by introducing themselves and establishing a relationship of mutual trust (BHSP). They also explained the intervention to respondents, provided information related to health education, and requested patient participation. Furthermore, they obtained informed consent as a form of agreement from the patient and agreed to a timeframe before the health intervention began. After the consent process was completed, researchers conducted initial observations of the infants' general condition prior to immunization, including physical condition, comfort level, and behavioral responses prior to the procedure. The study was then conducted on two infants with similar demographic characteristics, including age/date of birth, gender, and type of immunization administered.

In the intervention case (Baby A), audiovisual distraction was provided using a playmate music set that delivered visual and auditory stimuli during the immunization procedure. The device was positioned and operated by the researcher at a distance of approximately 20–25 cm from the infant and activated 2 minutes before immunization (Özdemir & Tüfekci, 2012). It remained active throughout the procedure and post-immunization observation period, with a total intervention duration of approximately 5–7 minutes. The auditory stimulus consisted of soft instrumental nursery music played at a comfortable sound intensity of 70–80 dB, while the visual stimulus consisted of brightly colored displays designed to attract the infant's attention. The infant was encouraged to focus on these stimuli before and during vaccine administration to divert attention from the painful injection stimulus, an approach that has been reported as an effective non-pharmacological strategy for reducing procedural pain in infants and young children.

In the non-intervention case (Baby C), the infant underwent the routine immunization procedure without audiovisual distraction. All other aspects of the immunization procedure, including injection technique, setting, and post-immunization observation, were conducted in the same manner as in the intervention case.

During the immunization process, researchers observed the infants' pain responses using the FLACC scale. Measurements were taken immediately after the immunization by observing facial expressions, leg movements, body activity, crying, and the infants' ability to be soothed. Observational data were then recorded on a research checklist for comparison between infants who received audiovisual distraction intervention and those without (Yadav et al., 2022).

Without Intervention	With Audiovisual Distraction Intervention (Playmate music set)
	

Figure 1. Activity Documentation

RESULTS

The findings presented in this section describe the observed pain responses of two infants during immunization procedures. Pain responses were assessed using the FLACC scale during and immediately after immunization. The observations were compiled descriptively to compare the pain responses of an infant who received audiovisual distraction using a playmate music set and an infant who did not receive the intervention. Given the case study design and the limited number of participants, the results are presented as descriptive observations and are intended to provide preliminary insights into the potential role of audiovisual distraction in supporting infant comfort during immunization procedures.

Table 1. Evaluation results

No	Respondent Group	Intervention	FLACC Observation Results	Total Score	Infant Response During Immunization	Evaluation
1	Baby A (Intervention Group)	Provided audiovisual distraction using a playmate music set	**Face:**1 (slight wince) **Legs:**1 (light leg movements) Activity: 1 (light fidgeting) **Cry:**1 (cry for a while) **Consolability:**1 (easily calmed)	5	The baby appeared to be paying attention to the music and hanging toys on the playmate. Crying was brief after the injection, and the baby calmed down more quickly after the procedure.	Audiovisual distraction interventions help reduce pain responses and make it easier to calm babies during immunization procedures.
2	Baby C (Non Intervention)	No audiovisual distraction intervention was provided.	**Face:**2 (clear grimace) **Legs:**2 (pulling and kicking the legs) **Activity:**2 (severe anxiety) Cry: 2 (crying loudly and continuously) Consolability: 2 (difficult to calm down)	10	The baby cried loudly during and after the injection. The baby appeared restless, difficult to calm, and showed a negative response to the immunization.	The absence of distractions causes the baby's pain response to be higher, so the baby appears more anxious and is difficult to calm down during the immunization procedure.

An evaluation was conducted during the immunization process to observe infants' pain responses following the use of audiovisual distraction with a playmate music set. Pain responses were assessed during and immediately after immunization using the FLACC (Face, Legs, Activity, Cry, Consolability) scale. Descriptive observations indicated that Baby A, who received the audiovisual distraction intervention, obtained a lower FLACC score (5) than Baby C, who did not receive the intervention (10). Baby A appeared calmer, cried for a shorter duration, and was easier to soothe following the injection. In contrast, Baby C demonstrated a stronger pain response, characterized by persistent crying, increased body movements, and greater difficulty being soothed after immunization. These observations suggest a difference in pain responses between the two cases. However, given the case study design and the limited number of participants, no statistical analysis was performed, and the findings should be interpreted cautiously.

DISCUSSION

This case study explored the use of audiovisual distraction through a playmate music set during routine infant immunization. The infant who received the intervention demonstrated a lower FLACC pain score (5) than the infant who did not receive the intervention (10). Although the findings cannot establish effectiveness because of the limited number of cases, they suggest that audiovisual distraction may have the potential to reduce observable pain responses during immunization procedures.

The difference in FLACC scores observed in this study is consistent with previous evidence supporting the use of non-pharmacological interventions for procedural pain management in infants. The findings of the present study are consistent with those reported by Yadav et al. (2022), who investigated the effect of facilitated rocking movement during infant vaccination. Yadav et al. (2022) found that infants receiving the intervention exhibited significantly shorter crying times than those receiving routine care (35.79 ± 5.12 seconds vs. 59.71 ± 7.93 seconds, $p = 0.0001$).

Furthermore, one minute after vaccination, 92.9% of infants in the intervention group remained in the mild pain category, compared with only 28.6% in the control group (p = 0.0001). Similarly, in the present study, the infant who received audiovisual distraction using a playmate music set demonstrated a lower FLACC pain score than the infant who did not receive the intervention (5 vs. 10), representing a 50% lower pain score. Although different pain assessment instruments were used, both findings suggest that non-pharmacological distraction interventions may help reduce observable pain responses during immunization procedures.

The findings may also be interpreted in light of previous studies on audiovisual distraction. Shen (2023) reported that audiovisual distraction was associated with reduced pain and anxiety during invasive procedures in children by redirecting attention toward pleasant sensory stimuli. Music video distraction can help reduce children's pain sensitivity and stabilize heart rate, blood pressure, and respiratory rate during invasive procedures (Ramdhanie et al., 2024). Likewise, the infant receiving the playmate music set in this study appeared to demonstrate less crying and fewer distress behaviors than the infant in the comparison case. However, because only two cases were observed, these findings should be interpreted as exploratory rather than conclusive.

The findings of this study are consistent with previous research on distraction-based interventions for pain management in children. Nagpal (2023) reported that audio distraction during invasive procedures may help reduce pain perception by directing children's attention toward pleasant auditory stimuli rather than painful sensations. The use of music and interactive sounds has also been associated with increased relaxation and improved comfort during medical procedures. In the present study, the playmate music set provided a combination of visual and auditory stimuli, including attractive colors, movement, and music, which may have captured the infant's attention during the immunization procedure. This multisensory stimulation may have helped redirect attention away from the painful stimulus, potentially reducing crying and restlessness. Similar findings were reported by Yılmaz (2023), who found that visual stimulation, such as pictures and high-contrast colors, was associated with lower acute pain responses during vaccination in infants.

From a physiological perspective, audiovisual distraction may influence pain perception by diverting sensory attention within the central nervous system. When an infant's attention is focused on audiovisual stimuli, the transmission and processing of pain signals may be reduced, resulting in lower observed pain responses (Delport & Botha, 2025). This explanation is consistent with the Gate Control Theory, which proposes that non-painful sensory input can modulate or inhibit the transmission of pain signals to the brain through specific neurological mechanisms (Arro, 2022). Furthermore, Yantie (2023) reported that audiovisual distraction contributed to a more comfortable and calming environment for children undergoing medical procedures. Although these studies involved different interventions and populations, their findings provide contextual support for the observations reported in the present case study.

In contrast, the infant who did not receive audiovisual distraction demonstrated a higher FLACC score (10), accompanied by more intense crying, active body movements, and greater difficulty being comforted following immunization. These observations are consistent with reports indicating that immunization remains a distressing experience for many infants when pain-management strategies are not used (Mabbott & Bedford, 2023). Nevertheless, because the current study involved only a single comparison case, no causal relationship can be inferred.

Several limitations should be acknowledged. First, the study included only two cases, which substantially limits the transferability and generalizability of the findings and precludes statistical analysis. Second, observations were conducted during a single immunization session, making it impossible to evaluate the long-term effects of the intervention. Third, pain assessment relied on behavioral observation using the FLACC scale and was conducted by the same researcher who implemented the intervention, which may have introduced observer bias and affected the objectivity of the assessment. Finally, factors such as infant temperament, baseline comfort level, environmental conditions, and parental emotional responses may also have influenced the observed outcomes.

Therefore, the findings of this study should be considered preliminary and exploratory rather than conclusive. Future research involving larger sample sizes, more rigorous experimental designs, independent outcome assessors, and diverse age groups is needed to further investigate

the potential role of playmate music set–based audiovisual distraction in reducing pain responses and supporting infant comfort during immunization procedures. Studies involving different types of immunizations are also recommended to evaluate the consistency of the intervention across various clinical contexts. In addition, future research should incorporate objective physiological indicators, such as heart rate, blood pressure, and oxygen saturation, to enhance the accuracy of pain assessment. Exploration of other innovative and interactive audiovisual distraction modalities may also help identify more effective strategies for pain management in infants and children during medical procedures. Such evidence could support the integration of audiovisual distraction interventions into standard atraumatic immunization practices in healthcare settings.

CONCLUSION

This case study suggests that audiovisual distraction using a playmate music set may help reduce pain responses and discomfort in infants during immunization procedures. The infant who received the intervention demonstrated a lower FLACC pain score, appeared calmer during immunization, cried for a shorter duration, and was easier to soothe following vaccine administration compared with the infant who did not receive the intervention. These preliminary findings indicate the potential of playmate music set–based audiovisual distraction as a simple, safe, and practical non-pharmacological approach to support infant comfort and promote atraumatic immunization practices in primary healthcare settings. However, given the limited number of cases and the descriptive nature of this study, the findings should be interpreted with caution. Further research with larger sample sizes and more rigorous study designs is needed to confirm these observations and evaluate the broader applicability of this intervention.

ACKNOWLEDGEMENT

We would like to express our gratitude to all parties who supported or assisted in the research activities, including the manuscript reviewers, technicians who helped set up the equipment, and students who assisted with the survey.

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