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Effectiveness of Warm and Cold Compresses on Pain Levels Among Toddlers After Immunization in Community Health Services

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ABSTRACT

Post-immunization pain is a common physiological response among toddlers caused by tissue trauma following injection procedures. This condition may lead to discomfort, prolonged crying, and increased parental anxiety, potentially affecting adherence to subsequent immunization schedules. Therefore, effective and safe non-pharmacological interventions are needed to minimize pain. This study aimed to analyze the effectiveness of warm and cold compresses on pain levels among toddlers after immunization at the Mongolato Village Integrated Health Post, Gorontalo, Indonesia. A quantitative quasi-experimental study with a two-group pretest–posttest design was conducted involving 40 toddlers selected through purposive sampling and divided into warm compress (n = 20) and cold compress (n = 20) groups. Pain levels were measured using the FLACC observation scale. Data were analyzed using the Shapiro–Wilk normality test followed by paired t-test with a significance level of 0.05. The results showed that both warm and cold compress interventions significantly reduced pain levels (p = 0.001). However, warm compress therapy demonstrated greater effectiveness, with a larger reduction in mean pain scores compared to cold compress therapy. Warm compress intervention can be recommended as an atraumatic care strategy in community-based immunization services to improve children's comfort and support immunization program success.

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INTRODUCTION

Immunization is one of the most effective public health interventions for preventing infectious diseases and reducing morbidity and mortality among children. Despite its proven benefits, global immunization coverage remains a challenge. Haeuser et al. (2025) reported that although immunization programs have saved millions of lives, vaccination coverage has stagnated in several regions, including Indonesia, where basic immunization coverage has declined over the past decade.

In Indonesia, Chu & Rammohan (2022) found that although overall immunization coverage has improved, disparities in distribution and delays in vaccine administration remain significant, particularly in rural and underserved areas. Factors such as parental education, access to healthcare services, and knowledge of immunization schedules contribute to incomplete and delayed immunization coverage (Colomé-Hidalgo et al., 2020; de Oliveira Roque e Lima et al., 2023; Homel & Edwards, 2018)

One important factor influencing adherence to immunization schedules is the child's experience of pain during and after injection procedures. Injection-related pain is a common physiological response among

toddlers and may lead to significant discomfort, prolonged crying, sleep disturbances, and feeding difficulties (Fontes et al., 2018). Although not life-threatening, poorly managed pain can create negative experiences associated with immunization, potentially affecting future compliance. Therefore, healthcare providers play a critical role in implementing effective pain management strategies to improve children's comfort and support immunization programs (Bucci et al., 2020; Cherian et al., 2019; Taddio et al., 2021).

Pain management can be achieved through pharmacological and non-pharmacological approaches. One simple and widely applicable non-pharmacological intervention is the application of compress therapy at the injection site. Warm compresses work through vasodilation, which improves blood circulation and promotes muscle relaxation, while cold compresses reduce pain through vasoconstriction and inhibition of nerve impulse transmission. Previous studies have reported varying results regarding the effectiveness of these methods. Güngör et al. (2021) found that cold compress application was more effective in reducing post-immunization pain in infants aged 2–6 months, while other studies have highlighted the effectiveness of both warm and cold compress interventions in reducing procedural pain (Prameswari et al., 2023; Unesi et al., 2019; Wu et al., 2022)

However, most previous studies were conducted in hospital settings or mass immunization programs, limiting the generalizability of findings to community-based healthcare services. In addition, few studies have directly compared the effectiveness of warm and cold compresses among toddlers in community health posts (posyandu), which serve as primary preventive healthcare facilities in Indonesia. This gap highlights the need for empirical evidence to determine the most effective intervention for reducing post-immunization pain in community settings (Checa-Peñalver et al., 2024).

Therefore, this study provides novel evidence by comparing the effectiveness of warm and cold compress therapy in reducing post-immunization pain among toddlers in a community healthcare setting. The findings are expected to contribute to evidence-based nursing practice and support the implementation of atraumatic care strategies in immunization services. Thus, the aim of this study was to analyze the effectiveness of warm and cold compresses on pain levels among toddlers after immunization at the Mongolato Village Integrated Health Post, Gorontalo, Indonesia.

RESEARCH METHODS

This study employed a quantitative quasi-experimental design using a two-group pretest–posttest approach to analyze the effectiveness of warm and cold compress therapy on pain levels among toddlers after immunization. The study was conducted at the Mongolato Village Integrated Health Post, Gorontalo Regency, Indonesia, from October 14 to October 21, 2025. A total of 40 toddlers were selected through purposive sampling based on predetermined inclusion criteria and were divided into two intervention groups: the warm compress group (n = 20) and the cold compress group (n = 20). The dependent variable in this study was the level of pain experienced by toddlers after immunization. Pain levels were measured using the FLACC (Face, Legs, Activity, Cry, and Consolability) observation scale, a validated instrument commonly used to assess pain in young children. Data were collected through direct observation, interviews with caregivers, and supporting documentation. Data analysis was performed using SPSS software. The Shapiro–Wilk test was used to assess data normality, followed by the paired t-test to evaluate differences in pain scores before and after the intervention within each group. A significance level of $\alpha = 0.05$ was used to determine the effectiveness of the interventions.

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RESULTS

Respondent Characteristics

Table 1. Respondent characteristics at the study site

Characteristics	Classification	n	%
Age	0–12 months	33	82.5
	13–24 months	7	17.5
Gender	Male	12	30.0
	Female	28	70.0
Total		40	100

Data Source: Data Primer 2025

Based on Table 1, most respondents were aged 0–12 months (82.5%), while 17.5% were aged 13–24 months. In terms of gender, the majority were female (70.0%), while males accounted for 30.0% of the total sample. These findings indicate that infants in early developmental stages dominated immunization

participants, highlighting the importance of effective pain management due to their limited ability to verbally express discomfort.

Pain Levels Before Intervention

Table 2. Pain levels among toddlers before intervention

Pain Level	Warm Compress n (%)	Cold Compress n (%)
Mild	1 (5.0)	1 (5.0)
Moderate	14 (70.0)	15 (75.0)
Severe	5 (25.0)	4 (20.0)
Total	20 (100)	20 (100)

Data Source: Data Primer 2025

Based on Table 2, before the intervention, most toddlers in both groups experienced moderate pain following immunization. In the warm compress group, 70.0% experienced moderate pain and 25.0% experienced severe pain. Similarly, in the cold compress group, 75.0% experienced moderate pain and 20.0% experienced severe pain. These findings indicate that immunization procedures commonly produce significant pain responses among toddlers.

Effectiveness of Warm and Cold Compress Therapy

Table 3. Effectiveness of warm and cold compress therapy on post-immunization pain

Group	Mean Pre	Mean Post	Mean Difference	p-value
Warm compress	6.25	2.80	3.45	0.001
Cold compress	6.25	4.70	1.55	0.001

Data Source: Data Primer 2025

Based on Table 3, the mean pain score before intervention in both groups was 6.25, indicating moderate pain. After the warm compress intervention, the mean pain score decreased to 2.80, with a reduction of 3.45 points. In the cold compress group, the mean pain score decreased to 4.70, with a reduction of 1.55 points. The paired t-test showed statistically significant reductions in pain scores in both groups ($p = 0.001$). However, the warm compress intervention resulted in a greater reduction in pain compared to the cold compress intervention, indicating higher effectiveness in reducing post-immunization pain among toddlers.

DISCUSSION

The results of this study demonstrated that both warm and cold compress interventions were effective in reducing post-immunization pain among toddlers, with warm compress therapy producing a greater reduction in pain scores. These findings highlight the important role of non-pharmacological interventions in minimizing pain responses associated with invasive procedures in children. Physiologically, post-injection pain occurs due to the activation of nociceptors and the release of inflammatory mediators at the injection site, resulting in tissue irritation and discomfort. Therefore, appropriate interventions are necessary to enhance comfort while avoiding additional side effects.

The greater effectiveness of warm compress therapy is associated with its vasodilatory mechanism, which increases blood circulation, enhances cellular metabolism, and reduces muscle tension around the injection area. Improved circulation facilitates the removal of inflammatory substances and reduces stimulation of pain receptors, thereby lowering pain perception. In contrast, cold compress therapy works through vasoconstriction, which slows nerve impulse transmission and reduces swelling. However, the reduced blood flow and limited tissue relaxation may result in less optimal pain reduction compared to warm compress therapy.

These findings are consistent with previous studies reporting the superior effectiveness of warm compress therapy in reducing post-immunization pain. Agustiningrum et al. (2019) found that warm compress application resulted in lower pain scores compared to cold compress therapy among toddlers following outbreak response immunization. Similarly, Choirunissa et al. (2021) reported that warm compress therapy significantly reduced pain scores in infants after DPT-HB-Hib immunization. Mohamed Elshahat et al. (2023) also demonstrated that warm compress application effectively reduced pain responses measured using the FLACC scale. Furthermore, a systematic review by Üstündağ et al. (2025) concluded that non-pharmacological interventions, including heat and cold therapy, are safe and effective analgesic strategies with minimal side effects for infants undergoing vaccination.

Although cold compress therapy remains beneficial for controlling acute pain, its effectiveness may vary depending on the physiological response and clinical context. Nurjanah et al. (2025) reported that cold

compress therapy combined with comfort interventions significantly reduced pain intensity during infant immunization. This suggests that intervention selection should consider the child's physiological condition and the characteristics of the pain response. However, in the context of post-immunization pain, which involves inflammation and tissue tension, warm compress therapy appears to provide more adaptive physiological and comfort-enhancing effects.

The observed reduction in pain also indicates the importance of sensory stimulation in helping toddlers adapt to painful experiences. Children who experience greater comfort tend to show reduced crying, calmer facial expressions, and improved consolability. Warm compress therapy may therefore provide both physiological and psychological benefits by promoting relaxation and reducing distress. This is particularly important in preventing negative or traumatic perceptions associated with immunization procedures, which could influence future healthcare experiences.

Overall, this study contributes to evidence-based nursing practice by demonstrating the effectiveness of non-pharmacological pain management strategies in community healthcare settings. The implementation of warm compress therapy as part of atraumatic care represents a simple, safe, and practical intervention that can improve the quality of immunization services. In addition to reducing children's discomfort, this intervention may also increase parental trust in healthcare providers and support the success of immunization programs.

CONCLUSION

This study demonstrated that both warm and cold compress therapies were effective in reducing post-immunization pain among toddlers. However, warm compress therapy showed greater effectiveness in improving children's comfort and reducing pain intensity. These findings highlight the importance of non-pharmacological interventions as part of atraumatic care to enhance the quality of immunization services and improve children's overall experience during vaccination procedures.

SUGGESTION

Healthcare providers are encouraged to use warm compress therapy as a simple, safe, and practical intervention for pain management during immunization procedures. Future research is recommended to involve larger sample sizes and explore combinations of non-pharmacological interventions to strengthen scientific evidence related to pediatric pain management and improve clinical practice in immunization services.

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REFERENCES

Agustiningrum, R. D., Triharini, M., & Rachmawati, P. D. (2019). Efektifitas Kompres Hangat dan Kompres Dingin terhadap Tingkat Nyeri Balita Pasca Outbreak Response Immunization (ORI). *Pediomaternal Nursing Journal*, *5*(1 SE-Original Articles), 57–62. https://doi.org/10.20473/pmnj.v5i1.12356

Bucci, L. M., MacDonald, N. E., Freedman, T., & Taddio, A. (2020). Benchmarking public health pain management practices during school immunizations. *Canada Communicable Disease Report = Releve Des Maladies Transmissibles Au Canada*, *45*(10), 367–372. https://doi.org/10.14745/ccdr.v46i10a10

Checa-Peñalver, A., Lírio-Romero, C., Luiz Ferreira, E. A., Hernandes-Iglesias, S., García-Valdivieso, I., Pérez-Pozuelo, J. M., & Gómez-Cantarino, S. (2024). Effectiveness of Non-Pharmacological Interventions in the Management of Pediatric Chronic Pain: A Systematic Review. In *Children* (Vol. 11, Issue 12, p. 1420). https://doi.org/10.3390/children11121420

Cherian, V., Joice, S., & Stephenson, B. (2019). Mitigating Painful Vaccination. *The Indian Journal of Pediatrics*, *86*(5), 410–411. https://doi.org/10.1007/s12098-019-02862-2

Choirunissa, R., Widowati, R., & Anandah, H. P. (2021). The Effectiveness of Warm and Cold Compress In The Implementation Of Pain After DPT - Hb – Hib Immunization At BPM "D" Of Neglasari Sub-District Tangerang City In 2021. *STRADA : Jurnal Ilmiah Kesehatan*, *10*(1 SE-Articles), 943–951. https://doi.org/10.30994/sjik.v10i1.740

Chu, H., & Rammohan, A. (2022). Childhood immunization and age-appropriate vaccinations in Indonesia. *BMC Public Health*, *22*(1), 2023. https://doi.org/10.1186/s12889-022-14408-x

Colomé-Hidalgo, M., Donado Campos, J., & Gil de Miguel, Á. (2020). Monitoring inequality changes in full immunization coverage in infants in Latin America and the Caribbean. *Revista Panamericana de Salud Pública*, *44*, e56. https://doi.org/10.26633/RPSP.2020.56

de Oliveira Roque e Lima, J., Pagotto, V., Rocha, B. S., Scalize, P. S., Guimarães, R. A., de Lima, M. D., da Silva, L. N., da Silva Oliveira, M. D., Moura, W. É., Teles, S. A., Rosso, C. F., & Caetano, K. A. (2023). Low Vaccine Coverage and Factors Associated with Incomplete Childhood Immunization in Racial/Ethnic Minorities and Rural Groups, Central Brazil. In *Vaccines* (Vol. 11, Issue 4, p. 838). https://doi.org/10.3390/vaccines11040838

Fontes, V. S., Ribeiro, C. J. N., Dantas, R. A. N., & Ribeiro, M. do C. de O. (2018). Pain relief strategies during immunization. In *BrJP* (Vol. 1). scielo. https://doi.org/10.5935/2595-0118.20180051

Güngör, T., & Öztürk Şahin, Ö. (2021). Analysis of two non-pharmacological pain management methods for vaccine injection pain in infants: A randomized controlled trial. *Agri : Agri (Algoloji) Dernegi'nin Yayin Organidir = The Journal of the Turkish Society of Algology*, *33*(1), 15–22. https://doi.org/10.14744/agri.2020.54289

Haeuser, E., Byrne, S., Nguyen, J., Raggi, C., McLaughlin, S. A., Bisignano, C., Harris, A. A., Smith, A. E., Lindstedt, P. A., Smith, G., Herold, S. J., Nesbit, O. D., Noyes, T., Shalev, N., Olana, L. T., Aalipour, M. A., Aalruz, H., Abbasifard, M., Abbaspour, F., … Mosser, J. F. (2025). Global, regional, and national trends in routine childhood vaccination coverage from 1980 to 2023 with forecasts to 2030: a systematic analysis for the Global Burden of Disease Study 2023. *The Lancet*, *406*(10500), 235–260. https://doi.org/10.1016/S0140-6736(25)01037-2

Homel, J., & Edwards, B. (2018). Factors associated with delayed infant immunization in a nationally representative cohort study. *Child: Care, Health and Development*, *44*(4), 583–591. https://doi.org/10.1111/cch.12560

Mohamed Elshahat, H. T., Farg, H. K., & Mohammed, E. G. F. (2023). Effect of local heat and cold application for pentavalent vaccine injection pain in infants. *Assiut Scientific Nursing Journal*, *11*(37), 131–140. https://doi.org/10.21608/asnj.2023.205771.1569

Nisfu Nurjanah, Chandra Sulistyorini, Hestri Norhapifah, & Dwi Ida Puspitasari. (2025). The Effect of Cold Compress Therapy and Breastfeeding on Reducing Pain in Infants During Immunization (PCV) at Separi III Public Health Center. *Journal of Global Research in Public Health*, *10*(1 SE-Articles), 15–24. https://doi.org/10.30994/jgrph.v10i1.550

Prameswari, V., Sa'diyah, K., & Kusmindarti, I. (2023). The effectiveness of warm and cold compresses before infusion to reduce pain in children aged 1-6 years. *Placentum: jurnal ilmiah kesehatan dan aplikasinya*, *11*, 103. https://doi.org/10.20961/placentum.v11i1.65877

Taddio, A., Ilersich, A., McMurtry, C. M., Bucci, L. M., & MacDonald, N. E. (2021). Managing pain and fear: Playing your CARDs to improve the vaccination experience. *Canada Communicable Disease Report = Releve Des Maladies Transmissibles Au Canada*, *47*(1), 87–91. https://doi.org/10.14745/ccdr.v47i01a12

Unesi, Z. U., Sajed, A. S., & Sharifzadeh, G. R. S. (2019). The Effects of Manual Pressure on the Injection Site on Vaccination Pain Among Infants: A Two-Group Clinical Trial. *Modern Care Journal*, *16*(4), e95705. https://doi.org/10.5812/modernc.95705

Üstündağ, A., Göktaş, A., & Ünay, B. (2025). The effect of hospital preparatory education on parents: A randomised controlled trial. *Journal of Pediatric Nursing*, *82*, 87–94. https://doi.org/https://doi.org/10.1016/j.pedn.2025.03.005

Wu, Y., Zhao, Y., Wu, L., Zhang, P., & Yu, G. (2022). Non-Pharmacological Management for Vaccine-Related Pain in Children in the Healthcare Setting: A Scoping Review. *Journal of Pain Research*, *15*(null), 2773–2782. https://doi.org/10.2147/JPR.S371797