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Effectiveness Of The Pediatric Assessment Triangle (PAT) For Emergency Department Care: Literature Review

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ABSTRACT

Inappropriate use of triage can lead to negative impacts, one of which is the delay in diagnosis and appropriate treatment for pediatric patients who need immediate attention, which can increase the risk of complications and morbidity in pediatric patients. Pediatric-specific triage instruments are needed because there are significant differences in clinical conditions, disease responses, and treatment needs between pediatric and adult patients. Children have different physiological, anatomical, and psychological characteristics compared to adults. The purpose of this study was to determine the effectiveness of the Pediatric Assessment Triangle for care in the emergency department. The method used in this study is to use a literature review approach. The literature review search was conducted on 6 databases namely PubMed, Science Direct, Google Scholar, Scopus, Web of Science Scopus, and Cinahl using the keyword "Pediatric Assessment Triangle". Based on the search results, 924 articles were found and after filtering only 6 articles were used. The results showed that the Pediatric Assessment Triangle was effectively used to triage children in the emergency department. The conclusion of this study is that training or socialization about PAT is needed to increase knowledge and empower health workers involved in implementing the Pediatric Assessment Triangle (PAT).

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1. INTRODUCTION

The increase in the number of patients who come to the Emergency Room (IGD) affects the length of time patients wait to get service and treatment. The handling process that takes a long time has the potential to reduce service quality and patient satisfaction levels (Akhirul, 2020), (Khairil Amin Baso et al., 2023) state that triage is the first step in providing help in the emergency room which aims to reduce morbidity and mortality for every patient who comes. The triage process is carried out by grouping patients based on certain criteria. Currently, various triage methods are used, but all are guided by the principle of primary survey which includes assessment of airway, breathing, and circulation. After that, a secondary survey is conducted to improve the accuracy of the triage assessment.

Most hospitals in Indonesia have not implemented triage systematically (Nicki Gilboy, RN, MS et al., 2005). Inappropriate use of triage can cause negative impacts, one of which is the delay in diagnosis and appropriate treatment for pediatric patients who need immediate attention, which can increase the risk of complications and morbidity in pediatric patients.

Siregar & Wibowo (2019), stated that children are the largest vulnerable group in Indonesia and comprise the largest part of the population in developing countries. Meanwhile, according to the World Health Organization (WHO), the age range of children is between 0 to 18 years (Mega Kusumanata, 2013). According to research conducted by (Hohenhaus et al., 2008) that deficiencies in the application of child-specific triage can result in delays in recognizing the severity of illness and treatment priorities in pediatric patients. Therefore, there needs to be standardization regarding the use of pediatric triage instruments and the addition of seizure and dehydration components to pediatric triage instruments is very important to improve the quality of handling of pediatric patients in the emergency room.

Pediatric-specific triage instruments are needed because there are significant differences in clinical conditions, disease responses, and treatment needs between pediatric and adult patients. Children have different physiological, anatomical, and psychological characteristics compared to adults, thus requiring a specialized approach to assessment and treatment. In addition, proper application of triage in pediatric patients can help reduce misdiagnosis and promote better clinical outcomes (Cruz et al, 2017).

One of the pediatric-specific triage instruments is the Pediatric Assessment Triangle (PAT). This instrument is used to rapidly assess the level of urgency in children by relying on visual and auditory observations. PAT does not require special equipment and can be performed in a short time, making it effective for the initial assessment of a child's condition (Horeczko et al., 2013).

2. METHOD

2.1 Research design

The design in this study uses a literature review approach

2.2 Searching Method

The literature review search was conducted on 6 data bases PubMed, Science Direct, Google Scholar, Scopus, Web of Science Scopus, and Cinahl using the keywords "Pediatric Assessment Triangle". The approach method for preparing this systematic review uses the PICOT approach. Furthermore, literature searches were conducted on the database, selection and analysis of articles based on the results of the screening process, until finally the preparation of a systematic review which is operationally described in table 1.

Tabel 1. PICOT Framework

PICOT Framework	Study Overview
Problem/Patient/Population	Use of pediatric triage / children aged 1-18 years / admission through the emergency room
Intervention/Indicator	Use of the pediatric assessment triangle (PAT)
Comparison/ Control	Triage in adults
The Outcome	Effectiveness of pediatric assessment triangle (PAT) Instrument
Time / type of study	2019-2024/ quasy experimental, case report, cross sectional, RCT dan kohort study

2.3 Inclusion and exclusion criteria

In the process of searching and identifying articles, the authors conducted screening by determining several inclusion criteria, namely articles written in the last 5 years, designs using quasy experimental, case reports, cross sectional, RCT and cohort studies, language using English. Exclusion criteria set in this study are articles written more than 5 years, designs using Literature review and systematic review, language other than English.

2.4 Article update

Articles were selected from research over the past five years (2019-2024) obtained through literature search activities on selected databases including PubMed, Science Direct, Google Scholar, Scopus, Web of Science Scopus, and Cinahl. Article selection was based on topical relevance and open access availability of the full-text. The initial screening process was conducted by assessing the suitability of the topic through the title and abstract. If the article met the set criteria, the next step was to read the entire content of the article and analyze it with a critical approach.

2.5 Data extraction

The results of the literature search and identification are shown in the PRISMA flow chart in Figure 1.

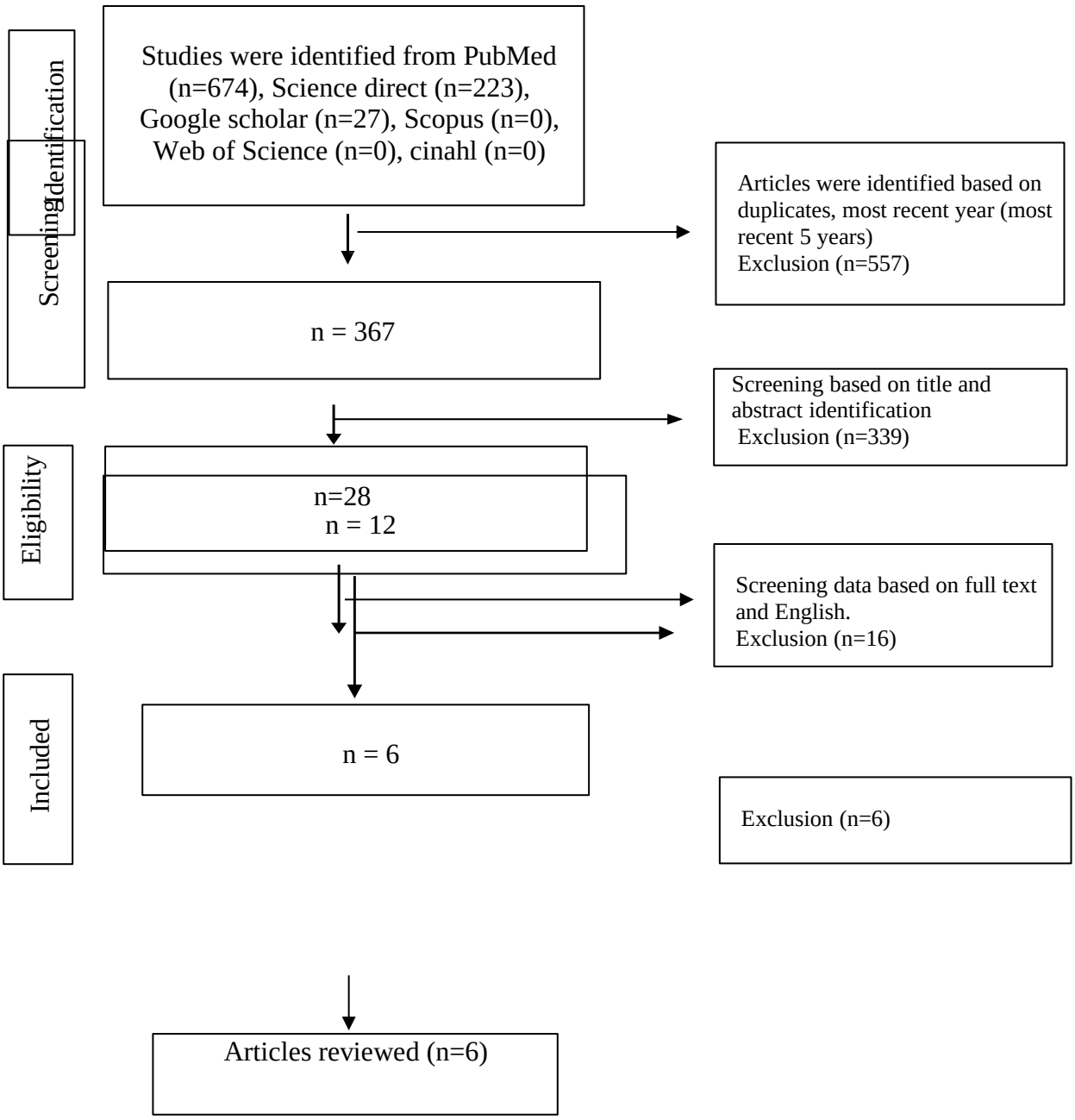


Figure 1: Study Selection Process

2.6 Quality research

The PRISMA flowchart in Figure 1 shows that a total of 924 articles were found from 6 data bases according to the predetermined keywords. Furthermore, the screening process was carried out based on the inclusion and exclusion criteria, so that 6 articles were obtained.

2.7 Data analysis

Articles that pass the screening stage will then be critically assessed using instruments from the Joanna Briggs Institute (JBI) (Barker et al., 2023). The JBI critical appraisal instrument is considered effective in assessing the credibility, relevance, and results of published research. In this study, the selection of the JBI checklist form was adjusted to the research method used in each article, then the results were compared with the predetermined assessment indicators.

3. RESULTS

A total of 6 articles were selected for critical analysis, with research designs consisting of cross-sectional mixed-methods, prospective observational study, retrospective cohort, quasi-experimental, namely pre and post test research design, qualitative observational and action research study. Each article was analyzed and critical appraisal was conducted using instruments from the Joanna Briggs Institute (JBI). The results of the analysis showed that the five articles met the criteria set and were worthy of inclusion in the review. Subsequently, the articles were analyzed in depth and presented in synthesis form in Table 2.

Table 2: Results of Analysis and Synthesis of Selected Journal Articles

No	Title, Authors, Year	Research Methods (DSVIA)	Research Results
1	*Knowledge, Awareness, and Understanding of Pediatric Triage Among Nursing Officers in India: A Multicenter Study* **Authors:** Varun Anand , Chandan K. Dey , Arvind Shukla , Murugan TP , Pugazhenthan T , Santosh K. Rathia , Sandeep Barman , Anil Kumar Goel , Niraj K. Srivastava , Harish Meena **Year** : 2023	Design: Cross-sectional mixed-methods Sample: 5,029 participants (paediatricians, physicians, nurses and midwives). Variables: Dependent: Knowledge, Awareness, and Understanding of Pediatric Triage Independent: Nursing Officers in India Analysis: ANOVA and post hoc analysis, Chi-	Nurses showed poor knowledge and awareness of the Pediatric Assessment Triangle (PAT) used for rapid initial evaluation (62.18% among all participants). Regarding the complete triage process applicable specifically to pediatrics in the ED, they had even less satisfactory knowledge and understanding, for example, identifying the primary disease (28.27%) and secondary survey components (22.69%) through history taking and focused examination, correctly using temperature assessment (23.32%) and instant blood glucose level assessment (22.95%) in triage, and knowing the different types

No	Title, Authors, Year	Research Methods (DSVIA)	Research Results
	Anand et al., 2023	square tests	of systems.
2	*The accuracy of the pediatric assessment triangle in assessing triage of critically ill patients in emergency pediatric department* **Authors:** Xiaomin, Yuanyuan Liu, Mingqing, Omorogieva lijuan Huang, Xiaohua Feng, Qiong Gao, Xiaohua Wang **Year :** 2021 Ma et al., 2021	Design: prospective observational study Sample: 1608 subjects Variables: Dependent: The accuracy of the pediatric assessment triangle Independent: assessing triage of critically ill patients Analysis: ANOVA and post hoc analysis, Chi-square tests	The critical children evaluated with PAT were 0.963. When the cutoff value of PAT score was 1, the sensitivity, specificity, PPV and NPV were 93.24%, 99.15%, 84.15% and 99.67%, respectively. The maximum YI value of PAT scored 1 is 0.924. For various disease categories, PAT performed better in assessing non-respiratory critical illnesses. PAT can be used as a rapid and effective assessment tool in emergency triage in China. When a child's PAT score is 1 or more, it is interpreted that the child's condition is critical and treatment priority should be set.
3	*In-hospital pediatric patient transfers to the pediatric emergency department* **Authors:** Oksan Derinoz Guleryuz **Year :** 2022 Güleryüz, 2022	Design: retrospective cohort Sample: 120 patients Variables: Dependent: In-hospital pediatric patient Independent: patients transferred to the pediatric emergency department Analysis: Chi-Square test	Data of patients 7.5% (69) were male and the median age was 42 months (0-210 months). 45.8% (55) were referred to the ED because their clinical condition required emergency care. According to the Pediatric Assessment Triangle (PAT) 54.8% of patients were stable and 78.6% fell into categories 3, 4, 5 according to the Emergency Severity Index (ESI). Only 4 patients received ESI life-saving procedures. 70% (84) were admitted to the emergency department. There was a statistically significant difference between PAT and ESI with the group of patients whose clinical condition required urgent care.
4	Effectiveness of E-Health Pediatric Assessment Triangle (PAT) on Response Time of Midwifery Students **Authors:** Maria Ulfah Kurnia Dewi, Nuke Devi Indrawati, Salsabila Rahmawati, Eno Noventa Rahma Dhani, Syifa' Ashil Rahadatul Aisyi, Ika Faricha	Design: quasi experiment, namely pre and post test research design. Sample: with simple random sampling consisting of 60 respondents divided into 30 control groups and 30 treatment groups Variables: Dependent:	After the intervention, the results of the difference test showed a difference in the response time of midwifery students post test between the control group and the treatment group (p-value = 0.000). The conclusion of this study is that the use of E-health Pediatric Assessment Triangle (PAT) has an impact on reducing response time in patient handling carried out by midwifery students in the treatment group.

No	Title, Authors, Year	Research Methods (DSVIA)	Research Results
	Zulfa, Yosefira Marliana Widyaningrum **Year :** 2024 Dewi et al., 2024	Effectiveness of E-Health Pediatric Assessment Triangle (PAT). Independent: Response Time of Midwifery Students Analysis: independent test and paired T test	
5	*Assessment of the Value of the PAT as the First Step in the Triage Process in a Pediatric Emergency Room* **Autor :** Ahmadi. A, Derakhshanfa H, Noori **Year** : 2023 Ahmadi et al., 2023	Design: qualitative observational Sample: 622 patients Variables: Dependent: Assessment of the Value of the PAT as the First Step in the Triage Process in a Pediatric Emergency Room Independent: - Analysis: univariate and multivariate analysis	PAT can quickly identify unstable cases that require hospitalization, reducing the likelihood of serious cases being overlooked. PAT by assessing appearance, respiration and circulation is effective in determining the severity of illness and the need for hospitalization. The high accuracy of PAT highlights the importance of physician training in the use of PAT to identify cases for hospitalization and urgency of care.
6	*Utilization of android-based paediatric assessment triangle application as an emergency detection tool for children* **Autor :** Wanda. D, Rahman. L, Apriyanti.E, Permaidah, Yayah, Asmarini. T, Amallia. I, Yuhana. I, Nastasyan. R. **Year** : 2024 Wanda et al., 2024	Design: action research study Sample: 9 nurses Variables: Dependent: Utilization of android-based paediatric assessment triangle application. Independent: emergency detection tool for children Analysis: SUS (System Usability Scale)	The PAT app proved to be a valid tool as the first step in identifying pediatric emergencies within <60 seconds. In addition to the time efficiency gained by nurses and doctors, the app also provides easy ER management to save children's lives, and can support government programs aimed at reducing child mortality.

4. DISCUSSIONS

The main principle in the triage process is to collect data and information about the patient's condition quickly, precisely, and clearly. Khairina et al., 2018 stated that errors in triage scale assessment or triage inaccuracy can extend the treatment time that patients should receive according to their clinical conditions. This risks reducing the level of patient safety and the quality of health services. Emergency patients must receive treatment in less than 5 minutes. If the response time in handling emergency patients is too long, then efforts to save patients can be reduced (Maatilu et al., 2014) .

The triage action aims to classify patients based on their level of severity so that they can immediately receive appropriate treatment (Ningsih, 2011). Pediatric Assessment Triangle (PAT) is a triage instrument used in children to conduct rapid assessments. PAT uses visual and auditory assessment, does not require equipment, and takes 30-60 seconds to do (Fernandez et al., 2017). The Pediatric Assessment Triangle (PAT) is an early identification tool to assess urgency in infants and children (Wasilah et al., 2023).

There are three components of the Pediatric Assessment Triangle (PAT) according to (Wasilah et al., 2023): Appearance, namely the appearance of the child can be assessed with various scales, namely the TICLES method which includes tone, interaction, consolability, how to look, talk or cry. Work of Breathing is an assessment of how effort is made when breathing, the characteristics that need to be considered are breath sounds, position, retraction, and nostrils (Pudjiadi, 2011 in Wasilah 2021). Circulation describes the adequacy of cardiac output and perfusion to vital organs. Circulation management can be carried out by assessing whether there are emergencies such as signs of pallor, mottling and cyanosis. Assessment by looking at appearance, breathing and circulation has obtained an overview of the child's distress without touching and using tools and can be done in less than 30 seconds.

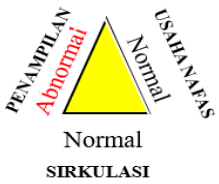
Table 3. Pediatric Assessment Triangle (PAT) Assessment

Assessment	Characteristic	Items Assessed
Appearance	Tone	Does the child move actively or resist examination strongly? Is the muscle tone good or paralyzed?
	Interactiveness	Sniffing, tripoding. Refusing to lie down, head bobbing (infant)
	Consolability	Can the parent or caregiver or examiner be calmed? Does the child continue to cry or appear agitated despite gentle approaches?
	Look/ Gaze	Is it possible to focus the vision? Is the vision blank?
	Speech/ Cry	Can the child speak or cry strongly? Is the voice weak?
Breathing	Abnormal breathing sounds	Snoring (stridor), grunting, wheezing, crackles
	Abnormal position	Sniffing position, tripoding, inclined sitting posture
	Retraction	Supraclavicular, intercostal, substernal, head bobbing (infants)
	Nose lobe	Nose lobe breathing on inspiration
Circulation	*Pallor*	White or pale color of the skin or mucous membranes
	Mottling	Pale-colored patches on the skin due to vasoconstriction
	Cyanosis	Bluish discoloration of the skin or mucous membranes.

Source: Wasilah (2021)

The interpretation of the Pediatric Assessment Triangle (PAT) is not used to determine the exact diagnosis but PAT is used to determine the severity of physiological function disorders and how to provide initial management (Wasilah et al., 2023).

Table 4. Interpretation of the Pediatric Assessment Triangle (PAT)

NO	APPEARANCE	INTERPRETATION
1		Stable condition
2		Respiratory distress / Airway condition
3		Respiratory failure condition
4		Compensated shock condition
5		Decompensated shock condition
6		Central nervous system (CNS) dysfunction / Metabolic conditions

NO	APPEARANCE	INTERPRETATION
7		Pulmonary heart failure condition

Based on the results of literature studies that have been reviewed, research by Ahmadi et al., 2023 and Wanda et al., 2024 on the Pediatric Assessment Triangle (PAT) discussed that assessment of appearance, breathing, and circulation in PAT is effective in determining the severity of illness and the need for hospitalization. The high accuracy of PAT emphasizes the importance of training medical personnel in its use to identify cases that require immediate care. PAT implementation has proven to be a valid tool in detecting pediatric emergencies in less than 60 seconds, increasing efficiency for nurses and doctors. The use of PAT also supports more structured emergency room management, contributes to saving children's lives, and helps reduce pediatric mortality.

According to research conducted by Güleryüz, (2022) that the Pediatric Assessment Triangle (PAT) is more effective for use in pediatric patients who require emergency care compared to the use of triage in adults with the Emergency Severity Index (ESI) instrument. This is supported by research conducted by (Ma et al., 2021) which states that the Pediatric Assessment Triangle (PAT) has better performance in assessing non-respiratory critical illness. The Pediatric Assessment Triangle (PAT) and Emergency Triage, Assessment and Treatment (ETAT) triage instruments are both more effective for pediatric patients than the Emergency Severity Index (ESI) or other triage. However, nurses' knowledge of the Pediatric Assessment Triangle (PAT) is still low. This is in accordance with research conducted by Anand et al., (2023) that nurses showed poor knowledge and awareness of the Pediatric Assessment Triangle (PAT). Training - training on pediatric triage Pediatric Assessment Triangle (PAT) proved to be beneficial for nurses. This is supported by research conducted by (King et al., 2021) that Emergency Triage, Assessment and Treatment (ETAT) training can increase knowledge and empower clinical officers and health cadres.

5. CONCLUSIONS

Pediatric-specific triage tools are needed as there are significant differences in clinical conditions, disease responses and treatment needs between pediatric and adult patients. The Pediatric Assessment Triangle (PAT) is used to rapidly assess the level of urgency in children by relying on visual and auditory observation. The application of PAT has proven to be a valid tool in detecting pediatric emergencies in less than 60 seconds, increasing efficiency for nurses and doctors. The use of PAT also supports more structured emergency management, contributes to saving children's lives, and helps reduce child mortality. Therefore, training or socialization about PAT is needed to increase knowledge and empower health workers involved in implementing the Pediatric Assessment Triangle (PAT).

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