Implementation of Clinical Pathways for Pediatric Patients with Acute Diarrhea and Their Therapy Management in a Hospital Setting: A Systematic Literature Review

Norman Dyanto and Diana Laila Ramatillah

Faculty of Pharmacy, University of 17 Agustus 1945, Jakarta 14350, Indonesia

Abstract: Clinical pathways, standardized care plans based on best clinical practices, aim to improve care quality and consistency for specific patient groups, including those with diarrhea or Acute Gastroenteritis (AGE). Pediatric emergency departments frequently encounter AGE cases, making it essential to streamline care. This systematic literature review, following PRISMA guidelines, investigated the impact of clinical pathway implementation on hospital stays and treatment outcomes for pediatric diarrhea patients. Out of 50 studies retrieved from databases like Google Scholar and Scopus, seven met the criteria, primarily from the USA, Egypt, and Indonesia. The analysis demonstrated a significant reduction in hospital stays (χ^2 = 55.79, P < 0.001), along with decreased intravenous fluid usage (15% to 9%) and reduced healthcare costs (USD 599 to USD 410) post-implementation. In conclusion, clinical pathways not only shorten hospital stays but also enhance diagnosis, treatment, and overall management of childhood diarrhea, emphasizing their crucial role in pediatric care.

1 INTRODUCTION

A clinical pathway is an evidence-based interdisciplinary care plan for a specific patient population to reduce unnecessary waiting times in treatment while simultaneously enhancing patient satisfaction and clinical outcomes (Siswanto and Chalidyanto, 2020). Clinical pathways have been developed to improve the quality and standardization of caring for specific diseases, including diarrhea.

In developing countries, diarrhea is a severe public health issue, especially among the youth population. Diarrhea continues to be the second leading cause of death in children under the age of five worldwide. Approximately two billion individuals suffer from diarrhea annually, including approximately one and a half million children under the age of five. Children under five years of age are more susceptible to diseases that compromise the immune system's ability to combat pathogens and are at a higher risk of contracting infections that cause acute diarrhea, including some viruses and parasites that do not induce diarrhea in healthier children (Merry et al. 2019).

Many hospitals have clinical pathways, but they have not been effectively implemented, rendering clinical pathways seemingly ineffective for patient therapy. This research aims to determine the effectiveness of implementing clinical pathways in pediatric patients with acute diarrhea in relation to medication usage and length of hospital stay (Siswanto and Chalidyanto, 2020). The clinical pathway is used in hospitals and various healthcare organizations across many parts of the world, including Asia (Aniza et al., 2016). It is utilized as an auditing and re-auditing tool and for quality assurance purposes (Wetherill et al., 2016).

Implementing clinical pathways directly affects the quality of healthcare services and patient safety (Buchert and Butler, 2016). Healthcare service quality can be enhanced by applying clinical pathways (Mater and Ibrahim, 2014). Fewer complications may occur in certain disease cases when clinical pathways are implemented in hospitals (Aniza et al., 2016).The implementation of clinical pathways can reduce readmission rates and healthcare costs (Buchert and Butler, 2016) and even improve patient satisfaction (Cudre et al., 2016; Wetherill et al., 2016).The patient feels satisfied and secure

because the doctor can elucidate the treatment particulars provided to the patient as outlined in the clinical pathway (Cudre et al., 2016). Patient safety can also be enhanced by implementing the clinical pathways (Asmirajanti et al., 2018).

2 METHOD

This research conducted a comprehensive literature review, guided by the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) methodology, to investigate the optimal implementation of clinical pathways for emergency care of pediatric patients with acute diarrhea in hospital settings. The study commenced by formulating specific research questions to guide the inquiry. The search for relevant literature was conducted within a defined timeframe, spanning from May 2023 to July 2023, and encompassed a range of reputable electronic databases, including Google Scholar, Scopus, Springer, and Google.

In the first phase of the literature review, the research team diligently scoured the selected databases for articles published in both English and Indonesian between 2017 and 2023. Their focus was on identifying literature related to the management of acute diarrhea in pediatric patients treated in hospital environments, with a particular emphasis on the implementation of therapeutic approaches. Subsequently, in the second phase, the initial pool of 50 identified literary works underwent a rigorous evaluation process, wherein articles were assessed for their suitability based on predefined inclusion and exclusion criteria. While the specific criteria were not explicitly detailed in the provided text, standard factors typically considered include relevance to the research questions, research methodology quality, and publication date.

Overall, this research methodically applied PRISMA guidelines to meticulously select and analyze pertinent literature, aiming to shed light on the most effective strategies for implementing clinical pathways in the emergency care of pediatric patients experiencing acute diarrhea in a hospital setting. The following criteria were used to determine what could and could not be included in these articles:

Inclusion Criteria:
1. The selected article is one that discusses the application of clinical pathways in pediatric patients with acute diarrhea and its effectiveness.
2. The full-text version of the selected article has been published in English and Indonesian.

3. The article was published between 2017 and 2023

Exclusion Criteria:
1. Articles are not focused on the clinical pathways of acute diarrhea.
2. Articles discussing the clinical pathways of diarrhea with complications related to cancer, autoimmune diseases, and/or HIV/AIDS.
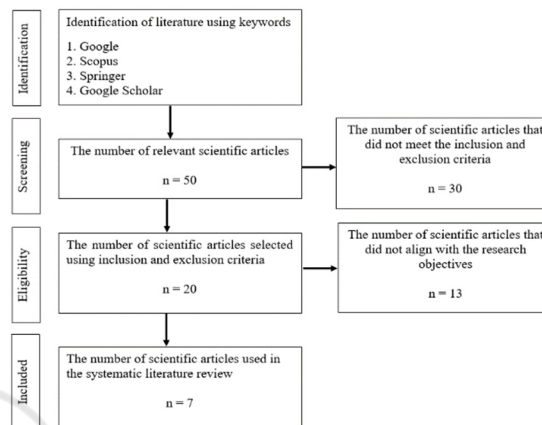

Figure 1: Scientific Article Selection Process.

Table 1: Pervious Research.

NO	TITLE	RESULTS
1	Effect of A Clinical Pathway Application on Outcome of Children Having Diarrheal Diseases	Children with diarrhea following a clinical pathway had fewer complications, shorter hospital stays, and fewer readmissions compared to those receiving routine care.
2	Impact of Patient Race/Ethnicity on Emergency Department Management of Pediatric Gastroenteritis in the Setting of a Clinical Pathway	Among 30,849 ER visits for AGE/dehydration, patients were NH-White (18.0%), NH-Black (57.2%), Hispanic (12.5%), and NH-other (12.3%). Multi-variable regre-ssion showed other NH patients were more likely to receive ondansetron. Black, Hispanic, and other NH patients were less likely to receive IV fluids or be hospitalized. NH-Black and Hispanic patients had shorter LOS without significant differ-rences in return visits to ED.
3	Clinical Pathway Produces Sustained Improvement in Acute Gastroenteritis Care	Implementation of the clinical pathway that emphasized oral rehydration therapy and Ondansentron. It reduced the use of IV fluids and LOS in children with Acute Gastroenteritis (AGE) in pediatric ED.
4	The Effect of Clinical Pathway	197 patients completed the clinical pathway. 60.91% had

NO	TITLE	RESULTS
	Compliance on Reducing Length of Stay	diagnostic exams, and 88.32% received therapy. No significant correlation (p > 0.05) existed between diagnostic or treatment compliance and patient hospitalization length.
5	Reduction in Resources and Cost for Gastroenteritis Through Implementation of Dehydration Pathway	A total of 7,145 patients met the inclusion criteria with a median age of 17 months. IV fluid usage decreased from an average of 15% to 9% after implementation. The average cost of healthcare-related treatment episodes decreased from USD 599 to USD 410. As a trade-off, there was an increase in ED length of stay, admission rate, and revisit rate.
6	Evaluation of a Nurse-Initiated Acute Gastroenteritis Pathway in the Pediatric Emergency Department	Among 643 patients, 392 received nurse-initiated care. They had 10.2% less IV fluid use (OR: 0.43; 95% CI: 0.27-0.68) and 7.4% fewer laboratory tests ordered (OR: 0.64; 95% CI: 0.43-0.94). Nurse-initiated care led to a 46-minute faster discharge after provider examination (P < .001), reducing overall length of stay (LOS) by 40 minutes (P < .001).
7	The Effectiveness of Clinical Pathway Implementation for Pediatric Patients with Acute Gastroenteritis (GEA) and Dehydration Treated Inpatient at Permata Bekasi Hospital	Before the clinical pathway, more patients received symptomatic antipyretic/analgesic therapy (43.3%), antiemetics (47.5%), and zinc (48.9%). Afterward, the percentages were 29.8%, 54.6%, and 64.5%, respectively. Hospitalization duration decreased after the clinical pathway (P < 0.000). Single antibiotic use (44.7%) or no antibiotics (53.2%) increased post-pathway, compared to before (35.5% and 17.7%). Ceftriaxone usage was highest both before (24.1%) and after (33.3%) the pathway. Clinical outcomes (discharge/recovery) showed no significant difference (P = 1.000). Overall, the clinical pathway at Permata Bekasi Hospital improved antibiotic rationality, reduced antibiotic use, and shortened hospital stays without affecting clinical outcomes for children with GEA and dehydration.

3 RESULTS

The first step in conducting this systematic literature review is searching for relevant articles published in English and Indonesian between 2017 and 2022. The provided data focuses on implementing clinical pathways and outcomes in pediatric patients with acute diarrhea. Subsequently, 50 publications are evaluated using inclusion and exclusion criteria, resulting in 7 selected articles of interest.

A study conducted in the Pediatric Department affiliated with Beni Suef University Hospital and General Beni Suef Hospital, Egypt, revealed that 90 pediatric patients suffering from diarrhea showed a highly significant statistical difference between the study group and the control group regarding hospital stay, with $x2 = 55.79$ at a level of $P < 0.001$. There was also a statistically significant difference between the study and control groups regarding hospital readmission after discharge, with $x2 = 25.74$ at $P < 0.000003$. Furthermore, there was a highly significant statistical difference between the study group and the control group regarding diarrhea complications in pediatric patients with diarrhea following the implementation of a clinical pathway at a level of $P < 0.001$. Lastly, there was a highly significant statistical difference between the group studied before and after the clinical pathway implementation concerning the physical examination of diarrhea in pediatric patients suffering from diarrhea, with a level of $P < 0.001$ (Merry et al. 2019).

A study conducted at the Children's Hospital of Philadelphia involving 30,849 Emergency Department (ED) patients meeting inclusion criteria for visits by children aged six months to 18 years with ESI levels 3 to 5 indicated cases of AGE/dehydration. Out of the 30,849 ED visits, there were 25,784 unique patients. The racial/ethnic composition of children included 5,545 (18.0%) NH-White, 17,650 (57.2%) NH-Black, 3,867 (12.5%) Hispanic, and 3,787 (12.3%) NH-others. NH-Black, Hispanic, and NH-other patients had shorter ED LOS compared to NH-White patients (adjusted coefficients [95% CI] = -21.35 [-25.90 to -16.79], -11.38 [-17.22 to -5.55], and -6.19 [-11.91 to -0.47], respectively). When compared to NH-White patients, NH-Black, Hispanic, and NH-other patients were less likely to be hospitalized (aOR [95% CI] = 0.54 [0.45 to 0.64], 0.62 [0.49 to 0.78], 0.76 [0.61 to 0.94]). There was no significant racial/ethnic difference in 72-hour return visits. The mixed-effects multivariable general linear regression, which controlled for age, gender, triage acuity, payer, and language, revealed that, compared to NH-White patients, NH-Other patients were more

likely to have received ondansetron (adjusted odds ratio [95% CI] = 1.30 [1.17 to 1.43]). NH-Black, Hispanic, and NH-Other patients were significantly less likely to have received IVF (0.59 [0.53 to 0.65]; 0.74 [0.64 to 0.84]; 0.74 [0.65 to 0.85]) or to have been hospitalized (0.54 [0.45 to 0.64]; 0.62 [0.49 to 0.78]; 0.76 [0.61 to 0.94] (Congdon et al., 2021).

A study conducted in the Division of Pediatric Emergency Medicine at Seattle Children's Hospital revealed 30,519 patients who met the specified criteria. There was no significant difference between the groups before and after the clinical pathway implementation regarding age, gender, or race/ethnicity. The group with the implementation of the clinical pathway showed a reduction in the length of stay in the emergency department, and the immediate provision of oral rehydration demonstrated significant data. There were challenges in implementing the clinical pathway, including opinions and practices that favored IV fluid administration over oral rehydration therapy (Rutman et al., 2017).

In a study conducted at a private hospital in Surabaya, Indonesia, there were 197 patients whose clinical pathways had been fully completed. In total, 60.91% of cases were collected for diagnostic examinations and 88.32% for therapy. The clinical journey and duration of patient hospitalization (combined = p > 0.05) did not correlate with patient compliance with diagnostic examinations (p > 0.05) or treatment (p > 0.05). The severity of the patient's illness is just one of several variables contributing to the patient's length of stay. Compliance with the clinical pathway did not contribute to a shorter hospitalization period in this study (Siswanto and Chalidyanto, 2020).

A study conducted on 7,145 patients at Boston Children's Hospital found that the use of IV fluids decreased from an average of 15% to 9% following implementation. The average episode cost of healthcare related to treatment decreased from $599 to $410. As a trade-off, there was an increase in ED length of stay, admission rates, and revisit rates. The implementation of Evidence-Based Guidelines (EBG) for patients with gastroenteritis resulted in a reduction in the frequency of IV administration, shorter inpatient stays, and lower healthcare costs (Creedon et al., 2020).

A study conducted at Children's National Medical Center, Washington, USA, out of 643 patients, 392 received nurse-initiated care. The proportion of intravenous fluids used was 10.2% lower (odds ratio [OR], 0.43; 95% confidence interval [CI], 0.27-0.68) and laboratory test orders were 7.4% lower (OR, 0.64;

95% CI, 0.43-0.94) in patients receiving nurse-initiated care. Discharge time after provider check-up was 46 minutes less in the nurse-initiated care group (P < 0.001), resulting in an overall reduction in LOS of 40 minutes (P < 0.0019) (Carson et al., 2017).

In a research conducted at Permata Hospital, Bekasi, Indonesia, there were 282 pediatric patients with Gastroenteritis (GEA) and dehydration (141 patients before the clinical pathway and 141 after the clinical pathway). The gender distribution of patients before (52.5%) and after (66.7%) the clinical pathway showed the highest prevalence of male patients, with the highest age range being 1-4 years before the clinical pathway (59.6%) and after the clinical pathway (50.4%). The most common comorbidity with GEA was typhoid fever before the clinical pathway (48.2%) and after the clinical pathway (36.2%), with the highest degree of dehydration being moderate dehydration before the clinical pathway (51.8%) and after the clinical pathway (63.1%). There was a difference in the number of patients who received symptomatic antipyretic/analgesic therapy before the clinical pathway (43.3%) and after the clinical pathway (29.8%), antiemetics before the clinical pathway (47.5%) and after the clinical pathway (54.6%), as well as zinc before the clinical pathway (48.9%) and after the clinical pathway (64.5%). The length of hospital stays for patients after the clinical pathway decreased compared to before the implementation of the clinical pathway (P-value 0.000). After the implementation of the clinical pathway, the use of a single antibiotic increased (44.7%), or no antibiotics were given (53.2%) compared to before the clinical pathway (35.5% and 17.7%), with ceftriaxone being the most common antibiotic before (24.1%) and after (33.3%) the clinical pathway. The clinical outcomes of patients before and after the clinical pathway allowed for discharge/recovery (P-value 1.000). The implementation of the clinical pathway at Permata Bekasi Hospital for pediatric patients with gastroenteritis and dehydration improved antibiotic rationalization, reduced antibiotic utilization, and decreased the length of hospital stay without affecting clinical outcomes (Adiwisastra et al., 2019).

4 DISCUSSION

The results of a systematic literature review of 7 selected articles reveal a significant correlation between the implementation of clinical pathways and the length of hospital stay for patients visiting the Emergency Department (ED) or admitted to inpatient

units. Several studies conducted in the ED on children with acute diarrhea indicate that implementing clinical pathways yields better outcomes in terms of length of hospital stay and patient outcomes upon discharge. Some studies even report that the implementation shortens the ED stay and reduces the treatment costs for patients treated using clinical pathways.

This systematic literature review is conducted by comparing the length of hospital stays before and after the implementation of a clinical pathway. The results obtained from each study conducted in various countries indicate that using standardized clinical pathways reduces the duration of treatment and yields better outcomes by preventing patient deterioration and excessive cost utilization.

Diarrhea still ranks as the second leading cause of death among children under the age of five worldwide. Approximately two billion people are afflicted with diarrhea each year, with 1.9 million of them being children under the age of 5 (Merry et al., 2019). The term "diarrhea" originates from the Greek language, meaning "to flow," a term used to describe this condition. Symptoms of diarrhea include an increased frequency of bowel movements or changes in stool consistency, both of which may be attributed to disruptions in digestion, absorption, and secretion (Hockenberry et al., 2017; Sharma, 2013). In children, diarrhea can be either acute or chronic, with varying degrees of severity, ranging from mild to moderate to severe. Mild diarrhea typically resolves independently without treatment within 1 or 2 days. In cases of severe diarrhea, a child may have persistent watery stools, exhibit symptoms of fluid and electrolyte imbalance, experience cramps, become highly irritable, and be difficult to comfort. Viruses in developed countries are the primary cause of most diarrhea cases, resulting in over 1.5 million outpatient visits and 200,000 hospitalizations yearly (Fleisher, 2014; Hockenberry and Wilson, 2015). The prevalence of diarrhea in Indonesia, especially acute diarrhea, remains relatively high (Kemenkes, 2017).

The primary goal in managing acute diarrhea includes assessing fluid and electrolyte imbalances. Oral Rehydration Solution (ORS) is one of the primary treatments for diarrhea worldwide because it is more effective, safer, less painful, and less expensive than intravenous rehydration (IV). Infants and children treated for acute diarrhea and initial dehydration are first administered Oral Rehydration Solution (ORS), followed by maintenance fluid therapy and appropriate dietary measures. Diarrhea treatment involves fluid replacement, resuming feeding, and monitoring infants and children closely.

Therefore, it is crucial to develop a clinical pathway for delivering healthcare services (El Baz, 2017).

The Clinical Pathway has been collaboratively developed by nurses, doctors, physical and occupational therapists, technicians, pharmacists, and other staff members involved in patient care (Chungyang, 2011). A Clinical pathway is a tool for a multidisciplinary care plan that outlines the essential steps required to treat patients with specific diagnoses, depicting patient care (Chungyang, 2011; Hollak et al., 2013). It is based on clinical pathway guidelines that optimize clinical outcomes while maximizing clinical efficiency. The use of clinical pathways has been shown to reduce patient length of stay, enhance interdisciplinary communication, and improve patient knowledge and self-awareness (Adiong, 2014; Hinkle et al., 2014). Clinical pathways represent a new approach to patient care, meeting many demands of clinical practice, and their enhancement allows for continuous evaluation and helps in stimulating research (Leigh and Resnick, 2014; Pirog et al., 2015). The implementation of clinical pathways in healthcare services has been proven to enhance patient outcomes, including hospitalization duration, treatment continuity, and service quality. Implementing clinical pathways for long-term hospitalizations will reduce patient risk, disability, and unnecessary costs (Merry et al., 2019; Piazza, 2015).

The primary objective of a clinical pathway is to enhance the quality of healthcare services by improving patient treatment outcomes, ensuring patient safety, increasing patient satisfaction, optimizing resource utilization, facilitating effective communication among healthcare service team members and with patients and their families, and minimizing unwarranted variations in patient care and length of stay. Prolonged hospitalization (Carman, 2016; Huiskes et al., 2012). The treatment process can be coordinated through role coordination and the sequence of activities within a multidisciplinary care team, providing documentation to patients and their relatives, monitoring and evaluating variations and outcomes, and identifying appropriate resources (Lux, 2012).

In Jakarta Teaching Hospital, diarrhea in children ranks fourth out of 10 major diseases that require inpatient care in both the Emergency Department (ED) and inpatient units. In this study, the authors conducted interviews with the clinical pathway team leader, pediatric specialist doctor, ED coordinator, and nursing coordinator. The interview with the clinical pathway team leader explained that the clinical pathway implemented in this hospital was

developed based on pediatric clinical practice guidelines and had been discussed in meetings involving the medical committee, nursing committee, pharmacists, and nutrition experts to establish integrated care services. The evaluation of the clinical pathway implementation revealed that patients treated using the clinical pathway had a significantly shorter length of stay compared to those who did not use the *clinical pathway*. An interview with a pediatric specialist reveals that clinical pathways are used to provide care for toddlers and children suffering from diarrhea. However, in some cases, this cannot be applied, such as when patients with the same diagnosis undergo drastic changes in their condition. In these instances, the clinical pathway is not employed in delivering care. An interview with the emergency department coordinator reveals that clinical pathways can be implemented and utilized in the initial management when patients arrive at the emergency unit. This facilitates the determination of therapy and reporting to the pediatric specialist if the patient continues to be hospitalized. The nursing coordinator states that the implementation of a clinical pathway facilitates other healthcare professionals in providing patient orientation, shift handovers, querying the sequence of doctor therapies, and evaluating the performance of staff in delivering patient care, thus ensuring that patients treated for acute diarrhea receive the best possible nursing care as outlined in the clinical pathway. Therefore, based on interviews with the relevant unit, it can be concluded that the implementation of the clinical pathway has a significant impact on patient care, reducing the length of hospital stays through standard treatment that yields better outcomes for infants and children with diarrhea.

5   CONCLUSION

The implementation of clinical pathways in various health conditions has resulted in a reduction in the length of hospital stays and therapy costs. These findings suggest that implementing clinical pathways offers better therapy than those without clinical pathways by enhancing the value of care through a reduction in hospital stay duration, costs, treatment, and resource utilization for patient therapy. It is crucial for future research to consider policies that advocate for the utilization of clinical pathways by clinicians and healthcare professionals in the treatment of children with diarrhea or other cases, aiming to provide better outcomes for patients. The results of a systematic literature review of seven

selected articles reveal the impact of implementing clinical pathways on the length of hospital stays for children with acute diarrhea.

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