

CRISIS AND CARE: GLOBAL TRENDS IN PEDIATRIC POISONING FIRST-AID PRACTICES (2000-2025)

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Abstract

The objectives of this review were to present pre-hospital first-aid measures administered by caregivers, identify the determinants underpinning both beneficial and harmful interventions, and evaluate the design, implementation, and outcomes of educational and policy initiatives aimed at improving caregiver responses. A scoping review was conducted in accordance with the PRISMA-ScR guidelines. We searched PubMed for articles published between January 1, 2000, and March 1, 2025, using keywords and MeSH terms related to paediatric poisoning and first-aid. Studies were included if they addressed pre-hospital first aid for acute poisoning in children aged 0–18 years. Two reviewers independently screened articles and extracted data on study characteristics, poisoning agents, first aid measures, determinants, and outcomes. A thematic synthesis was used to collate findings. From 59 unique records, 36 full texts were reviewed, and 17 studies met the inclusion criteria. Study designs included cross-sectional surveys (n=11), retrospective cohorts (n=3), interventional trials (n=1), programmatic studies (1) and systematic reviews (n=1), spanning nine countries across Asia, Africa, Europe, North America, and Oceania. Common pre-hospital interventions included dilution strategies (35–60%), emesis induction (10–40%), home remedies (5–15%), and immediate transport without any intervention (20–45%). Harmful practices—such as forced emesis, administration of herbal concoctions, and delaying professional care—were reported in 20–55% of poisoning events. Key determinants of first-aid behaviours included caregiver education level, socioeconomic factors, cultural beliefs, prior poisoning experience, and availability of poison control resources. Educational interventions significantly improved knowledge scores and correct first aid behaviours. Poison centre utilisation was markedly lower in LMICs compared to HICs. First-aid practices following paediatric poisoning are heterogeneous and frequently suboptimal, particularly in resource-limited settings. Tailored, culturally sensitive educational programs and expanded access to poison control services are essential to address the gaps in existing first-aid practices.

Keywords: Caregiver Behaviour, First Aid, Paediatric Poisoning, Educational Interventions, Poison Control Services

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Introduction

Acute poisoning remains a significant cause of morbidity and mortality among paediatric populations globally (Peden et al., 2008). Children's natural exploratory behaviours, coupled with developing physiological systems and smaller body mass, render them uniquely susceptible to adverse outcomes following toxic exposures (Carroquino et al., 2012). The World Health Organisation (WHO) estimates that unintentional poisoning accounts for approximately 45,000–50,000 deaths per year in children under five, with a disproportionately higher burden in low- and middle-income countries (LMICs) where regulatory and safety measures around household chemicals, pesticides, and pharmaceuticals may be inadequate (Peden et al., 2008).

The first few minutes to hours following ingestion or exposure to a toxin are critical (Chandran et al., 2019). Pre-hospital first aid measures administered by caregivers or lay responders can mitigate absorption, reduce symptom progression, and improve overall prognosis (Goldfrank et al., 2007). International guidelines—such as those published by the American Academy of Paediatrics (AAP), the European Resuscitation Council (ERC), and the International Liaison Committee on Resuscitation (ILCOR)—provide evidence-based recommendations for initial management, avoidance of forced emesis unless directed by poison control experts, and prompt transfer to professional care.

Despite these guidelines, numerous studies document persistent gaps between recommended and actual first aid practices. Traditional remedies—ranging from coconut milk to herbal concoctions—are still widely used in various cultural contexts (Ekor et al., 2014). In certain regions, inducing vomiting with manual stimulation or administering household agents like salt water persists due to deep-rooted beliefs about decontamination. Such practices can delay definitive treatment and may exacerbate toxin-related injury, leading to complications such as aspiration pneumonia, caustic injuries, or electrolyte disturbances (Peden et al., 2008).

Understanding the landscape of caregiver behaviours in the immediate aftermath of paediatric poisoning is vital for designing effective interventions (Weerasinghe et al., 2025). While several localised studies have examined specific practices or assessed educational programs, a comprehensive synthesis spanning different regions and intervention types is lacking. A scoping review approach allows mapping of the breadth and depth of existing research, identification of patterns and determinants, and recognition of critical knowledge gaps.

Therefore, this scoping review aimed to systematically collate evidence from 2000 to 2025 on first aid practices following paediatric poisoning. The objectives of this review were to present pre-hospital first-aid measures administered by caregivers, identify the determinants underpinning both beneficial and harmful interventions, and evaluate the design, implementation, and outcomes of educational and policy initiatives aimed at improving caregiver responses. Additionally, the review sought to elucidate existing research gaps and to propose directions for future investigation and policy development.

Methods

Protocol and reporting

This scoping review was conducted following the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) framework. A protocol detailing objectives, eligibility criteria, search strategy, and data extraction methods was developed a priori.

Information sources and search strategy

A comprehensive search was performed in PubMed on April 1, 2025, for studies published between January 1, 2000, and March 1, 2025. The search combined MeSH terms and free-text keywords related to acute poisoning (“acute poisoning,” “acute toxicity,” “poisoning”) and first aid (“first aid,” “pre-hospital,” “caregiver response”), along with pediatric filters (“child,” “children,” “pediatric”). The search string was: ("acute poisoning"[Title/Abstract] OR "acute toxicity"[Title/Abstract] OR poisoning[MeSH]) AND ("first aid"[Title/Abstract] OR first aid[MeSH]) AND (child[Title/Abstract] OR children[Title/Abstract] OR pediatric[Title/Abstract]) NOT (snakebite OR jellyfish OR food poisoning OR insect bite). Manual searches of reference lists from included studies supplemented the database search. Only English-language publications were considered due to resource constraints for translation.

Eligibility criteria

Studies were deemed eligible if they involved children aged 0–18 years (WHO, 2017) who had experienced acute poisoning and reported on any pre-hospital or immediate first-aid interventions administered by lay caregivers. The review included original research employing observational designs—such as cross-sectional surveys, cohort studies, and case series—as well as interventional studies, including quasi-experimental and randomised controlled trials. Systematic reviews were excluded because they represent a higher level of synthesis and differ in methodological intent and process from primary research studies typically included in a scoping review. Only peer-reviewed articles published in English were considered. Excluded were studies focusing solely on envenomation (e.g., snake or jellyfish stings), foodborne poisonings, vaccine reactions, adult-only cohorts, non-toxicologic emergencies, conference abstracts, commentaries, and editorials.

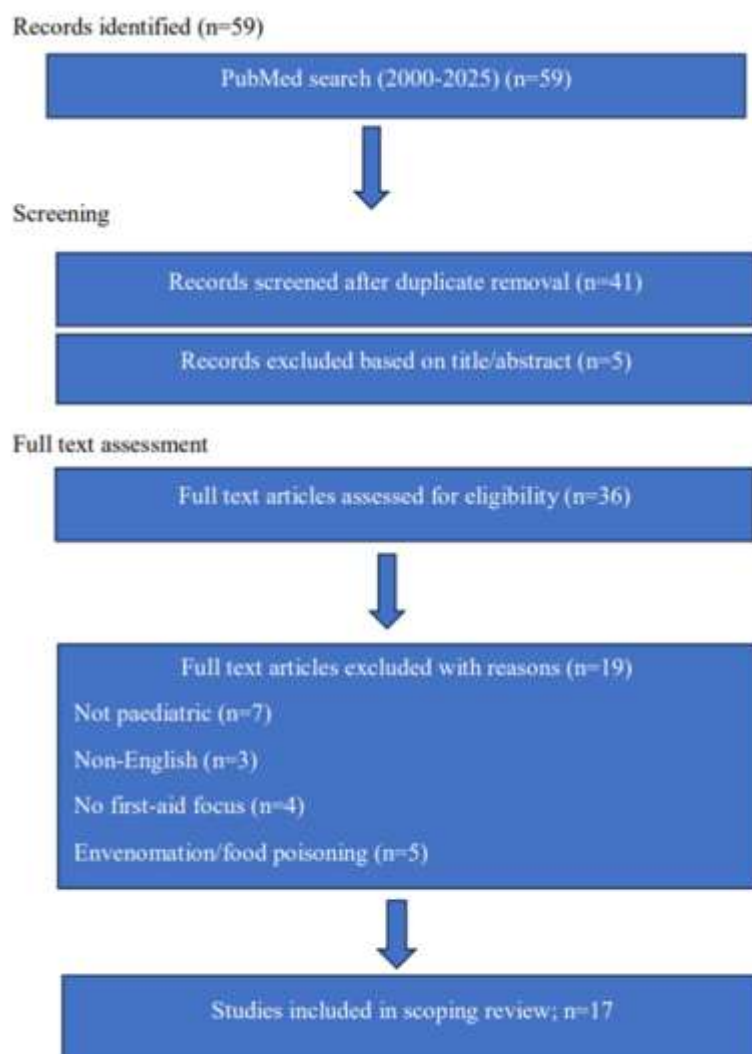


Figure 01: PRISMA-ScR flow diagram of study selection

Study selection

Two reviewers independently screened titles and abstracts. Full-text articles of potentially relevant studies were retrieved and assessed for eligibility. Discrepancies were resolved through discussion and, if necessary, consultation with a third reviewer.

Data extraction

A standardised data charting sheet was developed and pilot-tested on five studies. From each study, we extracted the following variables: the study identifiers (author, year, and country); the study design and setting; population characteristics, including sample size and age range; the type of poisoning agent involved; the first-aid measures described, which we categorised as dilution, emesis induction, adsorbent use, home remedies, or no intervention; the determinants influencing first-aid behaviours (for example, caregiver education, socioeconomic status, and cultural beliefs); and, for interventional studies, details of the intervention and its outcomes, such as changes in knowledge scores, behaviour-change metrics, and duration of follow-up.

Data synthesis

Data were synthesised to accommodate quantitative evidence. First, quantitative data—including study characteristics, sample sizes, prevalence of specific first-aid practices (e.g., dilution, emesis induction, use of home remedies), and proportions of caregivers demonstrating correct or harmful behaviours—were summarised descriptively. Frequencies and percentage ranges were identified to highlight variability across geographic regions and study designs.

Results

Overview of included studies

The initial search identified 59 unique records; after title/abstract screening, 36 full texts were assessed, and 17 studies met the inclusion criteria.

Geographic distribution: Studies originated from Sri Lanka (n=5), Egypt (n=2), Pakistan (n=1), Japan (n=1), the USA (n=3), Australia (n=1), India (n=2), Ghana (n=1), and European countries (n=1), among others. This diversity underscores global interest in paediatric poisoning first aid. Table 01 reflects the 17 studies that met our inclusion criteria, covering cross-sectional surveys, cohort analyses, interventional trials, and reviews across nine countries.

Table 01: Summary of included studies

Evidence	Country
Patterns and determinants of potentially harmful first aid practices in children with acute poisoning (n=384) (Dayasiri, 2025)	Sri Lanka
Accidental and Deliberate Self-Poisoning with Medications and Medication Errors among Children in Rural Sri Lanka (n=410) (Dayasiri et al., 2020)	Sri Lanka
Acute pesticide poisoning in the paediatric age group (n=155) (Dayasiri et al., 2017)	Sri Lanka
Plant Poisoning among Children in Rural Sri Lanka (n=325) (Dayasiri et al., 2017)	Sri Lanka
Kerosene Oil Poisoning among Children in Rural Sri Lanka (n=313) (Dayasiri et al., 2017)	Sri Lanka
Acute Poisoning Among Children Admitted to Alexandria Poison Centre, Egypt: Patterns and Predisposing Factors (n=350) (Abd El-Aziz et al., 2024)	Egypt
The effect of educational programs on parents' knowledge, behaviour, and practices regarding aluminium phosphide poisoning and its first-aid measures (n=98) (Nada et al., 2025)	Egypt
Parental knowledge, attitude, and practices about chemical and medicinal poisons: A hospital-based study from Karachi, Pakistan (n=364) (Parveen et al., 2023)	Pakistan
Current management for foreign body and toxic agent ingestion in a paediatric primary emergency centre. (n=580) (Ninchoji et al., 2024)	Japan
Web Poison Control: Can poison control be automated? (n=9256) (Litovitz et al., 2016)	USA
Investigating the reliability of substance toxicity information found on the Internet in pediatric poisonings. (n=21) (Kearney et al., 2013)	USA
Synthesis of the Network of Australian Poisons Services' Health Outcomes and Treatment (SNAPSHOT) investigators. Patterns of poisoning exposure at different ages: the 2015 annual report of the Australian Poisons Information Centres (Huynh et al., 2018)	Australia
Unintentional Poisoning and Bites during Childhood in Ujjain, Madhya Pradesh. (n=48) (Pathak et al., 2019)	India

A retrospective analysis of acute organophosphorus poisoning cases admitted to the tertiary care teaching hospital in South India (Kumar et al., 2014)	India
The experience of starting a poison control centre in Africa--the Ghana experience. (Clarke et al., 2004)	Ghana
First aid interventions by laypeople for acute oral poisoning. (Avau et al., 2018)	Belgium
Pattern of pediatric zolpidem ingestions reported to Texas poison control centres, 2000 to 2006. (n=463) (Forrester et al., 2009)	USA

Study designs

The body of evidence on paediatric poisoning and first-aid practices encompassed a diverse range of study designs. Descriptive cross-sectional studies formed the backbone of the literature, including several hospital- and community-based investigations from Sri Lanka, Egypt, India, and Pakistan. These studies provided valuable snapshots of poisoning patterns, risk factors, and harmful first-aid practices among children (Dayasiri et al., 2017; Nada et al., 2025). Retrospective chart reviews and poison centre-based case series analysed large datasets over time to understand exposure trends and clinical outcomes (Ninchoji et al., 2024; Litovitz et al., 2016; Kearney et al., 2013; Avau et al., 2018). A smaller subset comprised interventional studies, notably the quasi-experimental design, which evaluated the impact of structured educational programs on parental first-aid responses to aluminium phosphide poisoning (Nada et al., 2025). Programmatic and narrative studies, such as Clarke's account of establishing the Ghana Poison Control Centre, contributed practical insights into poison control infrastructure and public health strategies (Clarke et al., 2004). Finally, systematic reviews, such as the Cochrane review by Avau et al., synthesised global evidence on first-aid interventions by laypeople, offering a higher level of evidence to guide best practices (Avau et al., 2018). This diverse methodological landscape enriched the understanding of paediatric poisoning, from descriptive epidemiology to intervention effectiveness and system-level responses. Sample sizes ranged from 21 to 9,256 participants.

Poisoning agents

Common agents included household chemicals (detergents, disinfectants), medications (analgesics, anticonvulsants), pesticides (organophosphates, aluminium phosphide), and miscellaneous toxins (cleaning solvents) (Dayasiri et al., 2020; Peden et al., 2008; Weerasinghe et al., 2025). No studies on foodborne or envenomation poisonings were included.

First-aid practice patterns

First aid interventions were categorised into five primary types:

Dilution strategies

Administering water or milk to dilute ingested toxins was reported in 35–60% of cases across studies. In Sri Lanka, a study found that 13.8% of caregivers administered water and 11% provided milk or coconut milk as first-aid measures before bringing the child to the hospital, reflecting common cultural practices and beliefs about neutralising ingested poisons (Dayasiri et al., 2025). Similarly, in Egypt, a study reported that 32% of caregivers gave water, 9% administered milk, and 3% used other methods to induce emesis, highlighting a pattern of potentially harmful pre-hospital interventions driven by limited awareness and lack of access to evidence-based guidance (Abd El-Aziz et al., 2024). These findings underscore the global need for targeted educational interventions to improve community-level first-aid responses in pediatric poisoning cases.

Emesis induction

Induction of vomiting, either through manual methods such as finger stimulation or via pharmacological means, was reported in 10–40% of pediatric poisoning events across studies (Dayasiri, 2025; Peden et al., 2008). A key driver of this practice was advice from relatives or traditional healers, cited in up to 50% of cases involving emesis, particularly in low- and middle-income settings (Pathak et al., 2019). In high-income countries, such as the United States, the influence of erroneous online recommendations was also notable (Litovitz et al., 2016). For instance, Litovitz et al. highlighted how caregivers acting on inaccurate internet-sourced advice contributed to inappropriate first-aid responses (Litovitz et al., 2016). These findings emphasise the persistent impact of misinformation and culturally embedded practices on first-aid behaviours, underscoring the need for accessible, evidence-based guidance tailored to diverse settings.

Adsorbent use

Home administration of activated charcoal was rare (2–5%), primarily in high-income countries where poison control centres recommended its use. Studies have noted that <5% of caregivers self-administered charcoal without professional guidance (Avau et al., 2018).

Alternative/home remedies

Administration of herbal concoctions, oils, and sugar solutions was documented in 5–15% of cases. In Sri Lanka and parts of India, coconut oil and herbal teas were commonly given, based on traditional medicine practices (Dayasiri et al., 2025; Pathak et al., 2019).

No pre-hospital intervention

A substantial proportion (20–45%) of caregivers opted for immediate transport to medical facilities without any first aid measures, often driven by fear, urgency, or awareness of poisoning severity (Dayasiri et al., 2017).

Determinants of first-aid behaviours

Three thematic determinants emerged:

Caregiver factors

Caregiver characteristics played a significant role in determining the type and appropriateness of first-aid measures administered during pediatric poisoning incidents. Lower levels of formal education were consistently associated with a higher likelihood of engaging in potentially harmful practices. For example, in Sri Lanka, caregivers with only primary education or no formal schooling had an odds ratio of 2.1 (95% CI: 1.3–3.4) for inducing emesis, often based on traditional or non-medical advice (Dayasiri, 2025). In contrast, prior experience with poisoning episodes appeared to foster more appropriate responses. Caregivers who had dealt with similar incidents in the past were more likely to demonstrate guideline-consistent behaviours, such as refraining from home remedies and waiting for professional medical advice before taking action (Litovitz et al., 2016). These findings suggest that both educational attainment and experiential learning significantly influence caregiver decision-making in poisoning emergencies.

Socio-cultural factors

Cultural beliefs and misinformation played a critical role in shaping caregivers' first-aid responses to pediatric poisoning. In many communities, deep-rooted traditions heavily influence treatment choices. For instance, in parts of South Asia, coconut milk was widely regarded as a universal antidote, believed to have 'cooling' properties that could neutralise ingested toxins—an idea rooted more in cultural

symbolism than in medical evidence (Pathak et al., 2019). Alongside traditional practices, misinformation from unverified internet sources and community-held myths further contributed to the continuation of potentially harmful first-aid measures, such as inducing vomiting or administering home remedies. These findings highlight the urgent need for culturally sensitive public education campaigns that address both traditional misconceptions and modern misinformation.

System-level factors

Healthcare accessibility significantly influenced caregiver responses during pediatric poisoning incidents. In many low- and middle-income countries (LMICs), long distances to health facilities, limited transport options, and associated costs often deterred families from seeking immediate professional care (Dayasiri et al., 2017). As a result, caregivers frequently resorted to home remedies and traditional first-aid practices as initial responses. Compounding this issue was the limited availability and awareness of poison control services. In LMICs, fewer than 10% of caregivers reported knowledge or use of poison helplines, in stark contrast to high-income countries (HICs), where 60–75% of poisoning cases involved the use of automated poison information systems (Litovitz et al., 2016). This disparity underscores the critical need to expand and promote poison control infrastructure in resource-limited settings.

Impact of educational and policy interventions

Targeted educational interventions have shown considerable promise in improving caregiver knowledge and practices related to pediatric poisoning. In Egypt, a study evaluated the impact of a structured educational program focused on aluminium phosphide poisoning (Nada et al., 2024). Following the intervention, the proportion of caregivers with satisfactory overall knowledge rose dramatically from 0.2% to 73.4% ($p < 0.01$), while appropriate first aid knowledge improved from 23.4% to 57.1%. Furthermore, the percentage of caregivers engaging in unsatisfactory first-aid practices dropped significantly from 71.6% to 17.4%, indicating the effectiveness of structured, context-specific training. In a separate initiative in the USA, a digital campaign using SMS reminders about poison hotline numbers and basic first-aid steps resulted in a notable reduction in unnecessary emergency department visits (Litovitz et al., 2016). These findings highlight the transformative potential of both in-person and digital educational strategies in promoting safer and more informed responses to pediatric poisoning events.

Gaps and limitations of evidence

Despite growing interest in improving first-aid responses to pediatric poisoning, significant gaps remain in the evidence base. Notably, few studies have explicitly linked first-aid practices to clinical outcomes, such as hospitalisation duration, complication rates, or recovery trajectories. Additionally, while some interventions demonstrated short-term improvements in knowledge and behaviour, longitudinal follow-up data were scarce, leaving uncertainties about whether these positive changes persist beyond six months. Another limitation is the lack of qualitative research; only a handful of studies included qualitative components that explored caregiver beliefs, fears, and motivations—insights that are crucial for designing culturally appropriate and sustainable interventions (Dayasiri et al., 2018). Finally, there is a marked geographic skew in the literature, with limited representation from South America and many parts of Sub-Saharan Africa, highlighting the need for more regionally diverse research to understand and address context-specific challenges in first-aid responses to childhood poisoning.

Discussion

This scoping review synthesises global evidence on first aid practices following paediatric poisoning, revealing substantial heterogeneity and frequent divergence from evidence-based guidelines. Harmful

behaviours—particularly forced emesis and unverified home remedies—remain common in diverse settings.

Despite clear recommendations against routine emesis induction, this practice persists at rates up to 40% (Pathak et al., 2019). The physiological risks—aspiration, mucosal damage, electrolyte disturbances—underscore the need for targeted education. Similarly, traditional remedies, though culturally ingrained, lack scientific validation and may delay care or cause adverse reactions (Pathak et al., 2019). Caregiver education emerged as a pivotal determinant; those with higher schooling levels demonstrated greater guideline adherence (Litovitz et al., 2016). This suggests that literacy and health education interventions may yield significant benefits. Cultural beliefs—while deeply rooted—present an opportunity for culturally sensitive messaging that leverages community influencers and integrates local knowledge systems. System-level barriers, including limited poison control infrastructure in LMICs, inhibit access to professional guidance (Pathak et al., 2019). Strengthening telephonic and digital helplines, subsidising toll-free numbers, and integrating poison information into primary healthcare can bridge this gap (Rothwell et al., 2011).

Educational programs—whether community workshops, school curricula, or digital campaigns—consistently improved knowledge and behaviours. Notably, interventions combining multiple modalities (face-to-face training plus printed materials plus digital reminders) achieved the greatest impact (Giguère et al., 2020). However, variability in follow-up durations and outcome measures limits comparability. Policy-level initiatives, such as mandatory poison education during prenatal classes or school safety regulations, hold promise for broader reach (Institute of Medicine (US) Committee on Poison Prevention and Control, 2004). Evaluations of these policies are scarce, indicating a need for systematic monitoring and reporting.

Future research should adopt longitudinal designs to assess the durability of caregiver behaviour changes over time and to establish clear links between pre-hospital interventions and clinical outcomes. Mixed-methods studies are also needed to elucidate the complex decision-making processes of caregivers, thereby informing the optimisation of intervention design and delivery. In addition, investigations into the cost-effectiveness of both educational and system-level strategies will be essential for guiding resource allocation and policy decisions. Finally, expanding research efforts to underrepresented regions and incorporating gray literature searches will help ensure a more comprehensive global understanding of first-aid practices in pediatric poisoning.

This review has several notable strengths. By conducting a comprehensive 25-year search, we captured the evolution of paediatric poisoning first-aid practices across diverse geographic, cultural, and health-system contexts. Dual-reviewer screening at both title/abstract and full-text stages minimised selection bias, while the use of a standardised, pilot-tested data-charting instrument ensured consistent and thorough extraction of key variables. However, our reliance on PubMed as the sole search engine and on English-language publications may have led to the exclusion of relevant studies indexed in other databases (e.g., Scopus, Embase) or published in non-English languages, including local or regional journals. Similarly, gray literature—such as government reports, NGO evaluations, and conference proceedings—was not systematically captured, potentially overlooking valuable implementation data and context-specific insights.

Conclusions and recommendations

First aid practices following paediatric poisoning vary widely and often fall short of guideline recommendations, particularly in resource-limited and culturally diverse settings. Harmful

interventions—forced emesis, unverified home remedies—are prevalent and pose significant risks. Caregiver education, system-level support through poison control services, and policy integration are key to improving pre-hospital management. Educational interventions across multiple platforms consistently yield knowledge and behaviour gains, but long-term impact and linkage to clinical outcomes require further study. Strengthening telephonic and digital poison information services, integrating first aid training into maternal-child health and school programs, and embedding monitoring systems will enhance reach and sustainability.

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