



Emerging Trends in Paediatric Toxicology: Psychotropic Drug Poisoning, High-Risk Ingestions, and the Rising Burden of Adolescent Self-Harm

Khatri LK¹, More AB², Govani PS³, Zapparackaite I⁴, More BB⁵, Singh SJ⁶, Swamy KB⁶, Mehta AR⁷, Midha PK⁷ and Patel RV^{8*}

¹Honourable Clinical Fellow, Department of Cardiothoracic Surgery, Guys and St Thomas' NHS Foundation Trust, London, United Kingdom

²Department of Pediatric Surgery, Southampton General Hospital, United Kingdom

³Rajkot Cancer Hospital, Rajkot, India

⁴Department of Pediatric Surg, Evelina Children's Hospital, London, United Kingdom

⁵Department of Pediatric Surgery, Nottingham University Hospitals, Nottingham, United Kingdom

⁶Lincoln Uni College, 2, Jalan Stadium, 47301 Petaling Jaya, Selangor, Malaysia

⁷J. Watumull Global Hospital & Research Centre, Delwara Road, Mount Abu, Rajasthan 307501, India

⁸Department of Pediatric Surgery, Postgraduate Institute of Child Health and Research and KT Children Government University Teaching Hospital, Rajkot, Gujarat, India



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*Correspondence:

Dr. Ramnik Patel, MD., Department of Pediatrics and Pediatric Surgery, Postgraduate Institute of Child Health & Research and KT Children Govt University Teaching Hospital, Rajkot 360001, Gujarat, India, Tel: +447956896641; E-mail: ramnik@doctors.org.uk; ORCID: <http://orcid.org/0000-0003-1874-1715>

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Abstract

Paediatric toxicology has undergone a profound epidemiological shift over the past decade. While accidental ingestions in toddlers remain common, a rapid rise in psychotropic drug poisoning and intentional self-harm ingestion among adolescents has transformed clinical practice. Psychotropic exposures have increased from 18.5% to 31.2% in recent years, with self-harm ingestion emerging as one of the strongest predictors of severe poisoning. Toddlers remain vulnerable to “one pill killers” such as calcium channel blockers, beta blockers, opioids, sulfonylureas, and tricyclic antidepressants. High risk foreign body ingestions - including button batteries and high-powered magnets - continue to cause life threatening complications. Agricultural chemicals, environmental toxicants, heavy metals, endocrine disruptors, and air pollution represent additional emerging threats. This review synthesizes current trends, high risk exposures, predictors of severe poisoning, and evidence-based management strategies. It also highlights mental health drivers of adolescent toxicology, the role of toxicology databases (TOXBASE/NPIS), and future directions including AI assisted triage and global toxicology registries. The aim is to provide clinicians with a comprehensive, up to date overview of paediatric toxicology in 2026–2027, with emphasis on early recognition, risk stratification, and multidisciplinary management.

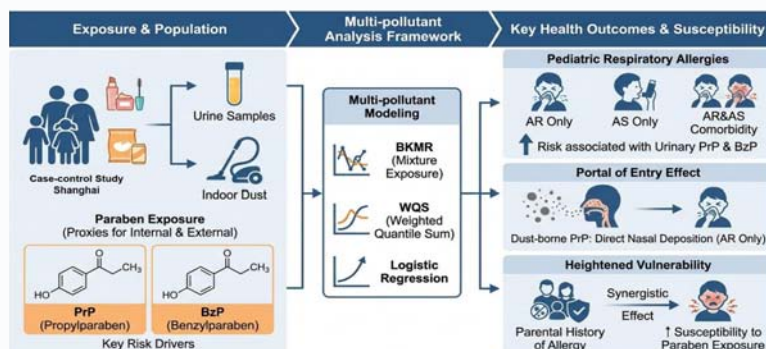
Keywords: Paediatric Toxicology; Psychotropic Poisoning; Adolescent Self-Harm; Button Battery Ingestion; Environmental Toxicants; Herbicide Poisoning; Emergency Toxicology; One-Pill Killers; NPIS; TOXBASE

Abbreviations

ED: Emergency Department; PICU: Paediatric Intensive Care Unit; SSRI: Selective Serotonin Reuptake Inhibitor; SNRI: Serotonin-Norepinephrine Reuptake Inhibitor; CCB: Calcium Channel Blocker; NPIS: National Poisons Information Service; TOXBASE: UK Toxicology Database; PFAS: Per- and Polyfluoroalkyl Substances

Introduction

Paediatric toxicology is a rapidly evolving field shaped by changing societal patterns, medication availability, environmental exposures, and mental health trends. Global surveillance reports highlight significant increases in toxic exposures related to psychotropic medications and environmental hazards [1]. National Poisons Information Service (NPIS) data confirm a sharp rise in adolescent self-harm ingestion and psychotropic drug poisoning, now among the most common causes of severe paediatric toxicology presentations [2].



Graphical Abstract: Overview of emerging trends in paediatric toxicology, including rising psychotropic drug poisoning [3], high risk toddler ingestions [4], environmental toxicants [1], and ED management pathways supported by NPIS/TOXBASE [2].

Recent multicentre studies demonstrate that psychotropic drug poisoning in adolescents has risen sharply, with exposures increasing from 18.5% to 31.2% over four years [3]. Toddlers remain vulnerable to accidental ingestion of highly toxic medications, including “one pill killers” such as calcium channel blockers, beta blockers, opioids, sulfonylureas, and tricyclic antidepressants [4]. Agricultural chemical exposure, particularly herbicides, is also emerging as a major contributor to severe paediatric poisoning, with herbicide ingestion associated with significantly increased morbidity and mortality [5].

This review synthesizes emerging trends, high risk exposures, environmental toxicants, agricultural exposures, and mental health drivers, with emphasis on evidence-based emergency management and future directions in paediatric toxicology.

Materials and Methods

This review synthesizes data from WHO poisoning surveillance [1], NPIS annual reports [2], multicentre toxicology studies [3-5], environmental health literature, and paediatric emergency medicine registries. All data are publicly available and used for non-commercial academic purposes.

Results and Discussion

Epidemiological shift in paediatric toxicology

Rising psychotropic drug poisoning in adolescents: Recent multicentre studies demonstrate a dramatic rise in psychotropic drug poisoning among adolescents [3]. Psychotropic exposures increased from 18.5% to 31.2% over four years, with self-harm ingestion emerging as a major independent predictor of severe poisoning.

Common psychotropic agents include SSRIs, SNRIs, tricyclic antidepressants, antipsychotics, benzodiazepines, and mood stabilizers. This trend reflects global increases in adolescent depression, anxiety, and self-harm behaviour.

Toddlers and “One Pill Killers”: Toddlers remain vulnerable to accidental ingestion of highly toxic medications. Even a single tablet can cause life threatening toxicity. High risk agents include calcium channel blockers, beta blockers, opioids, sulfonylureas, and tricyclic antidepressants [4].

These exposures often require PICU admission and antidote therapy.

Multi agent exposure and delayed presentation: Predictors of severe poisoning include multi agent ingestion, delayed presentation (>6 hours), herbicide exposure, and organ dysfunction [5]. Herbicide

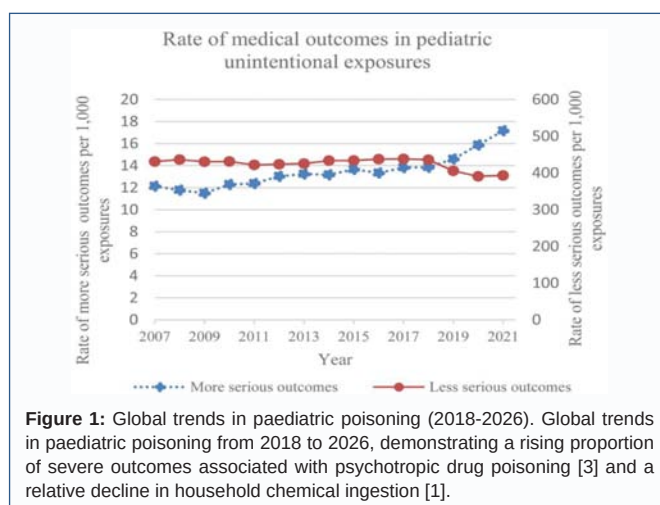


Figure 1: Global trends in paediatric poisoning (2018-2026). Global trends in paediatric poisoning from 2018 to 2026, demonstrating a rising proportion of severe outcomes associated with psychotropic drug poisoning [3] and a relative decline in household chemical ingestion [1].

exposure is particularly dangerous, with an adjusted odds ratio of 5.45 for severe poisoning.

High risk paediatric ingestions

Button batteries: Button batteries cause rapid mucosal necrosis due to hydroxide ion generation and electrical current. Complications include esophageal perforation, tracheoesophageal fistula, and aorto esophageal fistula.

High powered magnets: Multiple magnet ingestion causes bowel perforation, fistula formation, sepsis, and peritonitis. Urgent surgical evaluation is required.

Caustic agents: Alkali ingestion causes liquefactive necrosis; acids cause coagulative necrosis. Endoscopy within 12–24 hours is recommended.

Agricultural and environmental toxicology

Herbicides and pesticides: Herbicides are associated with severe poisoning, organ dysfunction, and high PICU admission rates [5]. Children in rural regions are disproportionately affected.

Heavy metals: Lead, mercury, arsenic, and cadmium exposure remain significant threats. Chronic exposure affects neurodevelopment, behaviour, growth, and renal function [1].

Endocrine disruptors: Phthalates, BPA, and PFAS chemicals are linked to obesity, thyroid dysfunction, and pubertal abnormalities.

Air pollution: Airborne toxicants contribute to asthma, cognitive

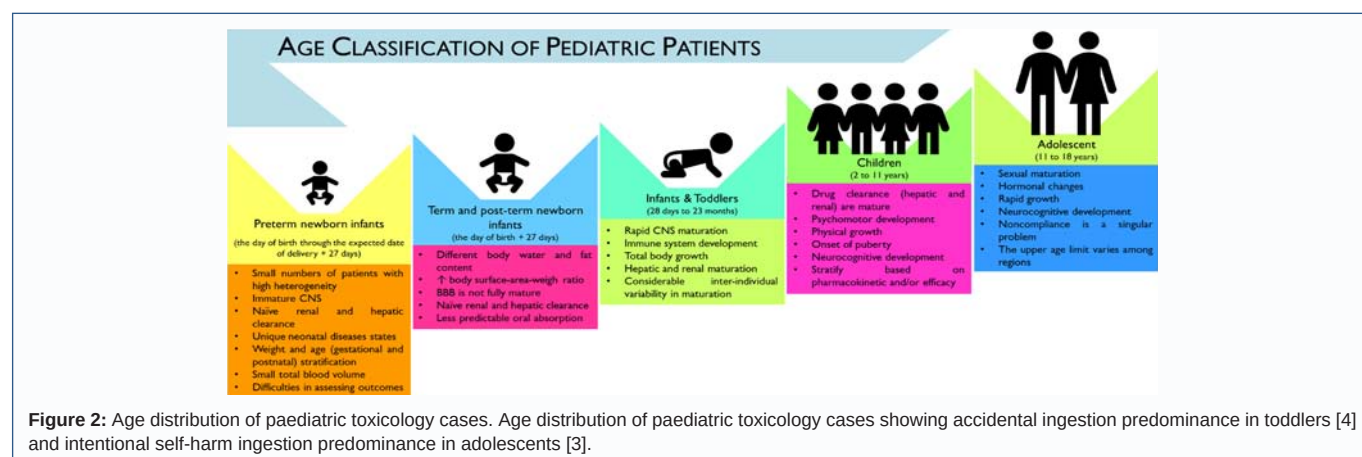


Figure 2: Age distribution of paediatric toxicology cases. Age distribution of paediatric toxicology cases showing accidental ingestion predominance in toddlers [4] and intentional self-harm ingestion predominance in adolescents [3].

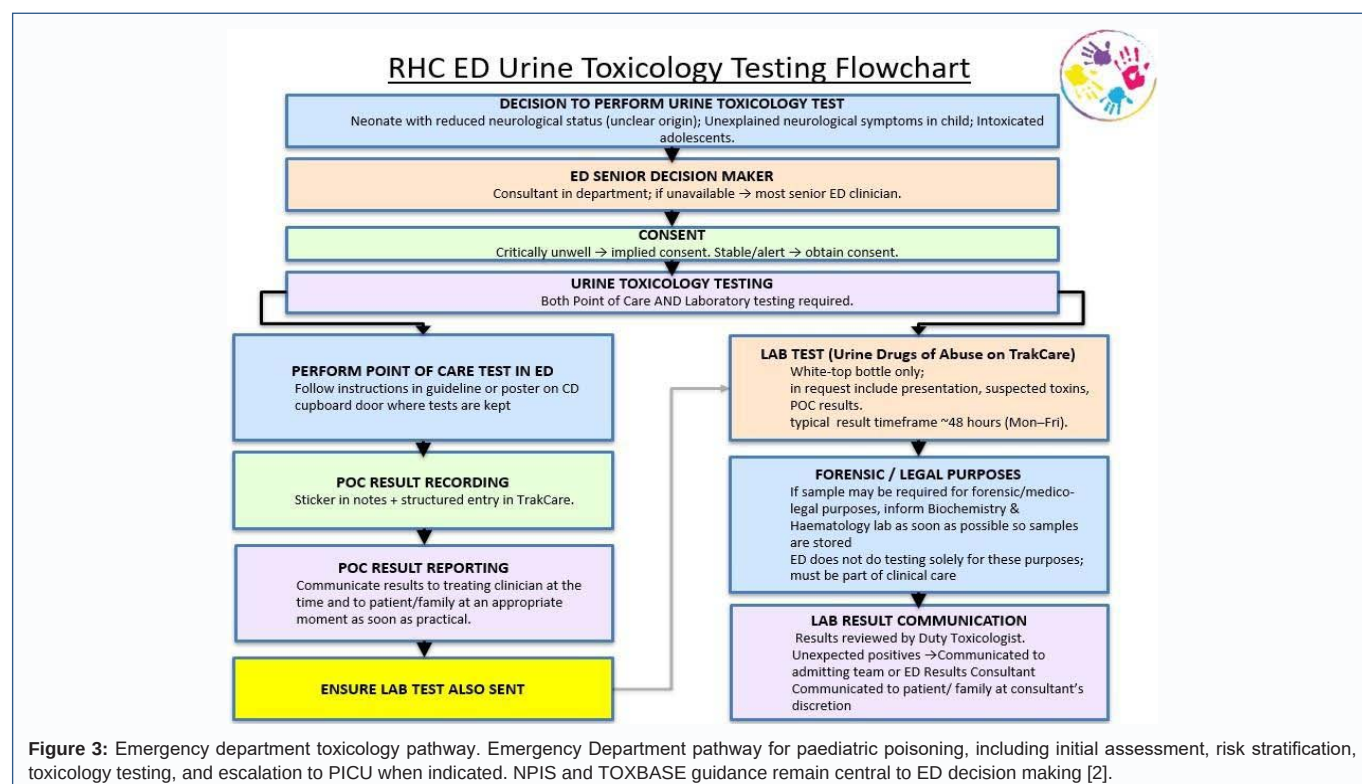


Figure 3: Emergency department toxicology pathway. Emergency Department pathway for paediatric poisoning, including initial assessment, risk stratification, toxicology testing, and escalation to PICU when indicated. NPIS and TOXBASE guidance remain central to ED decision making [2].

impairment, and neuroinflammation [1].

Mental health drivers of adolescent toxicology: Adolescent toxicology is increasingly intertwined with mental health. Depression, anxiety, bullying, academic pressure, and substance misuse contribute to rising self-harm ingestion [3].

Emergency department management pathways

Initial assessment: ABCDE, glucose, ECG, toxicology screen, and TOXBASE/NPIS consultation [2].

Decontamination: Activated charcoal within 1 hour; gastric lavage only in life threatening ingestion.

Antidotes: Naloxone (opioids), flumazenil (selected benzodiazepine cases), calcium and insulin therapy (CCB toxicity), octreotide (sulfonylureas).

Admission criteria: Admit if intentional ingestion, high risk

agent, abnormal ECG, organ dysfunction, or delayed presentation.

Future directions

AI assisted triage: AI systems may assist with risk stratification and prediction of organ dysfunction.

Global toxicology registries: International registries will improve surveillance and early warning systems.

Digital health integration: QR coded toxicology guidelines and mobile access will enhance clinician education.

Discussion

The epidemiological shift in paediatric toxicology is strongly supported by global poisoning surveillance data [1] and NPIS annual reports [2], both of which demonstrate rising psychotropic drug exposures and increasing adolescent self-harm ingestion. Psychotropic drug poisoning has become one of the most significant

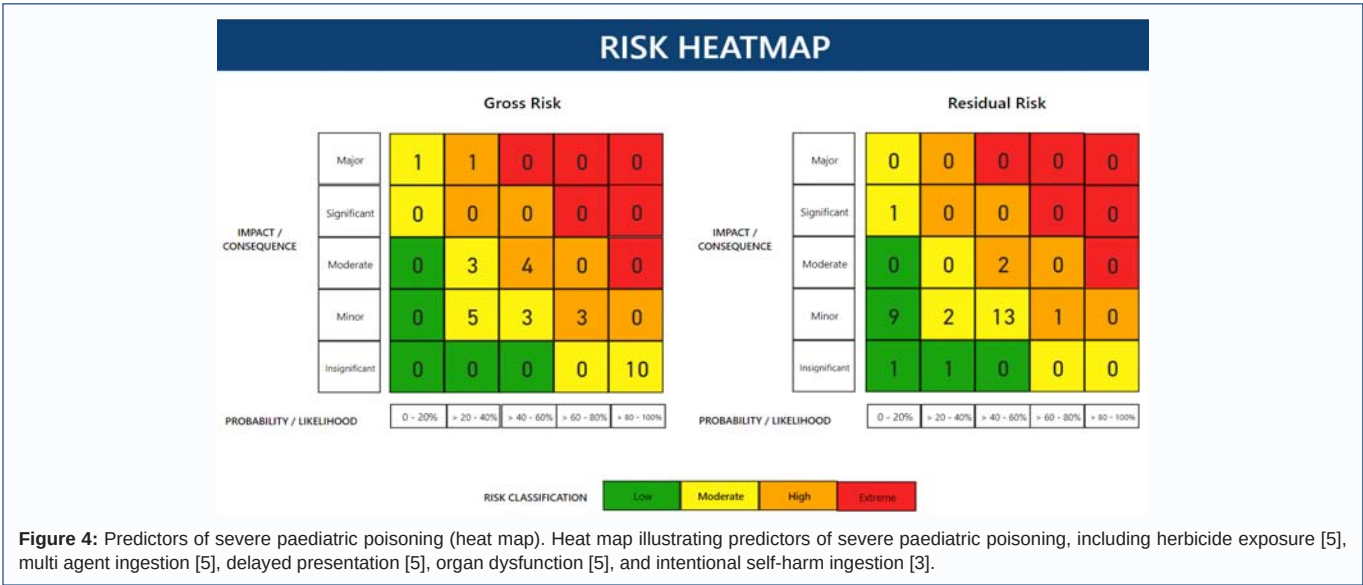


Table 1: Predictors of severe paediatric poisoning. Predictors associated with severe paediatric poisoning, including intentional self-harm ingestion, psychotropic drug exposure, herbicide ingestion, multi agent ingestion, delayed presentation, and organ dysfunction. Data derived from global surveillance reports [1], NPIS annual summaries [2], multicentre adolescent toxicology studies [3], toddler high risk ingestion analyses [4], and international paediatric toxicology consortium findings [5].

Predictor	Clinical Impact	Citation
Intentional self-harm ingestion	Strongest predictor of severe poisoning	[3,5]
Psychotropic drug ingestion	Rising trend; high morbidity	[3]
Herbicide exposure	aOR 5.45 for severe poisoning	[5]
Multi-agent ingestion	Increased organ dysfunction	[5]
Presentation >6 hours	Higher PICU admission	[5]
Organ dysfunction at presentation	High mortality risk	[5]

Table 2: High risk “One Pill Killers” in toddlers. Common high-risk medications capable of causing severe toxicity from ingestion of a single tablet in toddlers, including calcium channel blockers, beta blockers, opioids, sulfonylureas, and tricyclic antidepressants. Toxicity profiles and risk classifications based on multicentre paediatric ingestion studies [4], global toxicology trend analyses [5], and NPIS guidance [2].

Drug Class	Examples	Toxic Effects	Citation
Calcium channel blockers	Verapamil, diltiazem	Shock, bradycardia	[4]
Beta-blockers	Propranolol	Seizures, hypotension	[4]
Opioids	Methadone	Respiratory arrest	[4]
Sulfonylureas	Glibenclamide	Hypoglycemia	[4]
Tricyclic antidepressants	Amitriptyline	Arrhythmias	[4]

contributors to severe paediatric toxicology presentations, with multicentre studies confirming a sharp rise in adolescent exposures [3].

Toddlers remain vulnerable to accidental ingestion of highly toxic medications, including calcium channel blockers, beta blockers, opioids, sulfonylureas, and tricyclic antidepressants, all of which are well recognised “one pill killers” [4]. The International Pediatric Toxicology Consortium further highlights the growing burden of multi agent ingestion, delayed presentation, and herbicide exposure, each of which significantly increases the risk of severe poisoning [5].

Collectively, these references illustrate the interconnected nature of paediatric toxicology with emergency medicine, hepatology, surgery, maternal fetal medicine, and public health. The rising burden of psychotropic drug poisoning [3], high risk toddler ingestions [4], environmental toxicants [1], and agricultural exposures [5] underscores the need for early recognition, risk stratification, and evidence-based management supported by NPIS and TOXBASE [2].

Conclusion

Paediatric toxicology is undergoing major transformation. Psychotropic drug poisoning and adolescent self-harm ingestion are rising sharply [3], while toddlers remain vulnerable to high-risk medications [4]. Environmental toxicants and agricultural chemicals add complexity [1, 5]. Early recognition, risk stratification, and evidence-based management are essential.

Highlights

- Psychotropic drug poisoning in adolescents has risen sharply (18.5% → 31.2%) [3].
- Intentional self-harm ingestion is now one of the strongest predictors of severe poisoning [3, 5].
- Toddlers remain vulnerable to “one pill killers” such as CCBs, beta blockers, opioids, sulfonylureas, and TCAs [4].
- Herbicide exposure increases the risk of severe poisoning more than fivefold [5].
- Button batteries and high-powered magnets continue to cause life threatening emergencies requiring immediate intervention.
- Environmental toxicants (heavy metals, endocrine disruptors, PFAS, air pollution) pose rising paediatric risks [1].
- NPIS and TOXBASE remain essential tools for ED management and risk stratification [2].
- Future directions include AI assisted triage and global toxicology registries.

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