

# Pesticide Poisoning Among Children in India: The Need for an Urgent Solution

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## Abstract

Pesticides have been increasingly recognized as a significant source of morbidity and mortality, especially in the developing world. In particular, significant attention has been given to the use of pesticides to cause deliberate self-harm in India. Approximately half of suicides in India are due to intentional poisoning of which the majority are from pesticides. Young children are commonly poisoned by accidental ingestion, unintentional dermal or inhalational exposure, whereas adolescents are more severely poisoned if attempting self-harm through intentional ingestion. It is the purpose of this paper to highlight the problem of pesticide poisoning in the pediatric population of India, and to recommend policy options to address this global problem. Reducing access to pesticides and educating farmers and the public regarding the proper storage and use of pesticides and the establishment of more poison centers in India can be part of a broader strategy to address these life-threatening poisonings in children.

## Keywords

Pesticides, Organophosphates, India, Pediatrics, Insecticides, Herbicides, Rodenticides

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## Introduction

Pesticides have been increasingly recognized as a significant source of morbidity and mortality, especially in the developing world. The impact that these widely used, yet potentially toxic chemicals cannot be understated. In particular, significant attention has been given to the use of pesticides to cause deliberate self-harm. This phenomenon has been particularly evident in India.

With over 1.3 billion people, India accounts for a large proportion of the global population, but bears an undue burden of the total number of suicides that occur annually around the world. Approximately 800 000<sup>1</sup> completed suicides occur each year worldwide of which, over 180 000 (22.5%) occur in India.<sup>2</sup> Approximately half of suicides in India are due to intentional poisoning of which the majority are from pesticides.<sup>2</sup> A pesticide is any substance used to kill, repel, or control plant or animal life that are considered to be pests. Pesticides include herbicides for destroying weeds and other unwanted vegetation, insecticides for controlling a wide variety of insects, fungicides used to prevent the growth of molds and mildew, disinfectants for preventing the spread of bacteria, and compounds used to control mice

and rats. These pesticides commonly include organophosphates, pyrethroids, paraquat, and rodenticides.

Although the focus of pesticide poisoning has been on suicide in India, and the plight of rural farmers who resort to intentional ingestion of pesticides,<sup>3,4</sup> there are other segments of the population that generally have been disregarded in this discussion. In particular, the pediatric population (0–18 years) has not received proper attention and intervention even though data on poisoning exists indicating that children are also significantly affected by pesticides.<sup>5–8</sup> Young children, especially toddlers, are commonly poisoned by accidental ingestion, unintentional dermal or inhalational exposure, whereas adolescents are more severely poisoned if attempting self-harm through intentional ingestion. It is the purpose

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of this paper to highlight the problem of pesticide poisoning in the pediatric population of India, and to recommend policy options to address this problem.

## Methods

### *Investigating the Pesticide Problem*

A scoping review, keyword search was completed in PubMed using the words “India,” “pesticide,” “poison,” and “children” together to find peer-reviewed articles relevant to the topic of pesticide poisoning in the pediatric population (ages 0-18 years) in India. Results were not restricted by time. The search yielded 56 results, which were sorted according to best match. Articles were reviewed to determine relevance to the topic. Careful attention was given to inclusion of keyword search terms within the article. In certain situations, keyword synonyms were considered acceptable; for example, the word “toxin” or derivatives of the word “toxin” were considered an acceptable substitute for “poison.” Articles that were not about pesticide poisoning, were not geographically about India, or were solely focused on the clinical features, management, and complications of pesticide poisoning were eliminated. A total of 24 papers were removed in this manner after review. An additional 10 papers were removed that were not available as full text articles in electronic format. The remaining 22 articles were reviewed to determine their utility in explaining the problem of pesticide poisoning in India or any potential policy interventions that could be implemented to resolve this problem. Eleven of these articles provided data on pesticide poisoning that was specific to the pediatric population and 10 were selected for inclusion in the final paper; 1 paper was excluded for lack of clarity on methodology. Additional papers were cited in the introduction and discussion sections that were discovered as part of background research for this topic.

### *Investigating Pesticide Policy Options*

The 22 aforementioned manuscripts that were selected for review to “investigate the problem” were examined for potential solutions or interventions that could be used to prevent or manage pesticide poisoning specific to the pediatric population in India. In addition to the 10 papers that were already selected for inclusion in the final paper, another 4 of these papers were found to be useful for inclusion on explaining policy options after reviewing the articles. Given that solutions or interventions for pesticide poisoning do not have to be restricted to 1 specific age group, an additional keyword search was completed in PubMed to identify studies that specifically focused

on interventions and solutions to pesticide poisoning in India. The keywords used were “India,” “pesticide,” “poison,” and “intervention,” and the results were not limited by time. The search yielded 138 results, which were sorted according to best match. Articles were examined specifically for mention of strategies, solutions, and interventions to prevent or manage pesticide poisoning in India. Any article that did not do so was deliberately excluded in order to narrow the focus to papers that would be most helpful in informing policy. Six papers were selected for inclusion after title review of which 2 were duplicates from the original search for investigating the problem of pesticide poisoning in India. The 4 new papers were added to the 4 papers from the original search for inclusion in the final paper.

## Results: Evidence of the Problem

### *Pesticide Poisoning Is Not a New Phenomenon*

The tragic reality of pesticide poisoning in children in India is that it is not a novel or recent occurrence. A retrospective study conducted at the Government Hospital for Children in Srinagar found that 15% of pediatric admissions for poisoning from 1983-88 were due to pesticides.<sup>9</sup> Another study from Cooper Hospital in Maharashtra found that pesticides were responsible for 9.6% of pediatric admissions from 1986 to 87.<sup>10</sup> In 1997 a hospital in Patna, India reported 20 cases of highly toxic aluminum phosphide poisonings in children ages 7 to 12 over the course of a single year.<sup>11</sup> A more extensive study of 8 different hospitals published in the *Indian Journal of Pediatrics* in 1998 found that pesticides, insecticides, and rodenticides contributed anywhere from 1.2% to 15% of total pediatric poisonings.<sup>12</sup>

### *Pesticide Poisoning Is Still a Problem*

At the turn of the millennium, a continued trend of pesticide poisoning in the pediatric population was documented. Some of the best evidence to this effect has come out of the National Poisons Information Center (NPIC) at the All India Institute of Medical Sciences in New Delhi. Between April 1999 and March 2002, it was found that 9.1% of phone calls for pediatric cases were due to poisoning by agricultural pesticides.<sup>6,7</sup> This is in addition to household pesticides, which included pyrethroids (20.3%), rodenticides (11.3%), and organophosphates.<sup>7</sup> Another retrospective study from NPIC showed that over 36% of phone calls for pesticide poisoning between 1999 and 2012 were for children below the age of 16.<sup>5</sup> An additional retrospective study of poisoning by

household products between 2006 and 2016 was completed by NPIC, which revealed that 57% of phone calls for household pesticide poisoning were for patients less than 18 years of age.<sup>8</sup>

Studies from other institutions in India also showed that pediatric cases of pesticide poisoning were significant. Concurrent to the studies from NPIC, a retrospective review of 30 cases of aluminum phosphide poisoning in children below the age of 14 between 2008 and 2013 was published from the Postgraduate Institute of Medical Science, Haryana, India.<sup>13</sup> This study illustrates the devastating impact of just 1 pesticide from 1 hospital over a span of 5 years as 14 of the 30 cases that were reviewed involved patients who did not survive, representing an extremely high case fatality rate of 46.6%. Another retrospective review from Mangalore, India identified 31 cases (38.2% of total) of pediatric poisoning by pesticides from 2010-11, which included organophosphates, paraquat, pyrethroids, and rodenticides.<sup>14</sup>

## Ethical Approval and Informed Consent

Ethical approval or informed consent was not required for this review because all information used in this review is publicly available.

## Discussion

### *Analysis of the Pesticide Problem*

It is important to note that despite a recognition that pesticides were a significant problem in the 1980s and 1990s, little is discussed about what should be done to prevent it. Dutta et al makes a passing reference to educating parents on safe storage of household toxins,<sup>12</sup> but no specifics are given. Given that these studies were primarily focused on reviewing poisoning cases from patient records, it is understandable that their primary purpose was to report the problem and attempt to interpret findings, not provide solutions. Second, it can be challenging to propose solutions for novel phenomena that are poorly understood. If pesticides were just beginning to be identified as a problem, it is unlikely that an adequate solution could be implemented expeditiously. In addition, pesticides were often not the most significant poisoning agent that was identified. Pharmaceutical medications, kerosene, and food poisoning all contributed significantly to the total number of pediatric poisoning cases, and pesticides were less of a contributor.<sup>9,10,12</sup> In light of this context, it is reasonable that pesticide poisoning—though recognized as a concern in the pediatric population—did not rise to the level of significant action

in the 1980s and 1990s. Yet this time period represents a potential missed opportunity to intervene and prevent pesticide poisoning in young children and adolescents

A few notable points from the 2000s and 2010s can be ascertained from the above data. (1) There appears to be an increase in the prevalence of pesticides as an agent of poisoning. Whereas earlier studies found incidence rates in the single digits up to 15%,<sup>9-12</sup> more recent studies have demonstrated that pesticides can account for more than a third of all poisoning cases in the pediatric population.<sup>7,14</sup> This suggests that there are other variables that are bringing children in to more frequent and proximal contact with pesticides. (2) Children are being exposed to a wide variety of chemical compounds that collectively fall under the umbrella term “pesticides.” These include insecticides, organophosphates, herbicides, pyrethroids, rodenticides, and paraquat among others.<sup>7,14</sup> (3) Young children are primarily exposed accidentally to pesticides,<sup>5-7,14</sup> which is in contrast to adolescents and adults who intentionally poison themselves to induce self-harm and commit suicide.<sup>6</sup> (4) A single poison information center in India accounted for a majority of the studies that provided age-specific data on pesticide poisoning.<sup>5-8</sup> The NPIC thus can serve as a role model for data collection on poisoning in other regions of India including rural and remote districts.

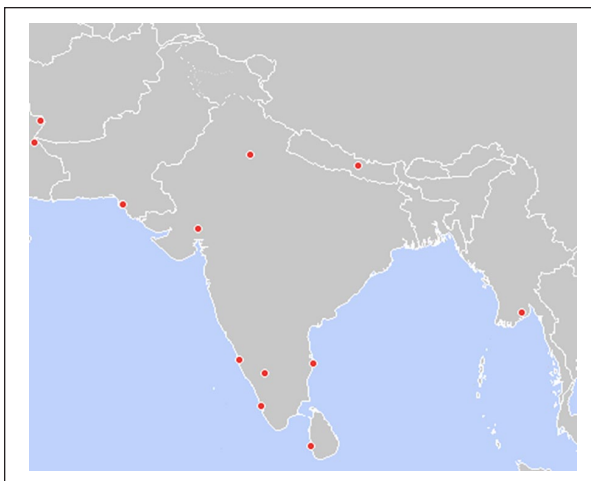
### *Solutions for the Problem*

*Policy option #1: Restrict pesticide availability.* A reasonable approach to reduce the impact of any toxic substance is to find ways to limit its availability. This can take various forms, from requiring certain storage practices to outright bans. A systematic review published in *The Lancet Global Health* found that bans on pesticides appeared to decrease suicide rates by pesticide ingestion in areas where they were instituted.<sup>15</sup> Included in the review was a study conducted in India where a pesticide called Endrin was banned in 2 districts in West Bengal; once the ban went into effect, suicides by pesticides decreased, but there was no clear change in the total number of suicides.<sup>15,16</sup> Another review of pesticide poisoning in Andhra Pradesh concluded that select restrictions on the most dangerous pesticides could reduce mortality due to pesticide poisoning.<sup>17</sup> Other studies examined efforts to restrict access by creating centralized storage facilities for pesticides in a district of Tamil Nadu, India where pesticides were kept in locked storage boxes in 2 facilities.<sup>3,4</sup> The findings of these studies suggested participants received the storage facilities favorably, and that they may have played a role in preventing some suicides by pesticide ingestion.<sup>3,4</sup>

The application of these studies to the prevention of pesticide poisoning in the pediatric population is limited because much of the focus has been on the adolescent and adult populations to prevent suicides. Nevertheless, the concepts of pesticide bans and restricted storage are still applicable for the pediatric population. Given that younger children are exposed accidentally to pesticides stored in the household,<sup>8</sup> removing hazardous pesticides from homes or from the community entirely could potentially reduce the impact of pesticides on the pediatric population. Additionally, making industrial and agricultural pesticide products less concentrated and distributed in smaller volumes are other avenues for prevention. Still, there are challenges to this approach, including enforcement and cooperation from community members. For example, organochlorines like endosulfan are reportedly banned in India, yet they continue to appear as sources of acute poisoning.<sup>18,19</sup> Moreover, treatment of acute poisoning from pesticides cannot be solved by reducing the availability of pesticides. Health resources including a rapidly deployed prehospital emergency medical system, adequate numbers intensive care units and ventilators, ample supply of personal protection equipment (PPE), as well as specific antidotes to treat these poisonings (e.g., atropine, oximes) will be required.

**Policy option #2: Educate the pesticide user.** Understanding the dangers associated with pesticide exposure is certainly key to reducing the morbidity associated with its use. As demonstrated by a study from a rural area of Madhya Pradesh, lack of education may have contributed to multiple cases of endosulfan poisoning caused by wheat flour kept in old pesticide containers.<sup>19</sup> There are not many examples of formal educational programs for pesticide use in India, but a study was carried out in Karnataka, India to determine if such a program could improve knowledge of safe pesticide practices.<sup>20</sup> Using a knowledge attitude and practice questionnaire, researchers concluded that knowledge did improve after educating farmers on pesticide safety and that such programs could prevent harmful pesticide exposure.<sup>20</sup> Another study from Andhra Pradesh found that educating farmers on integrated pest management (which is a method that relies on balancing pest and predator populations) led to a reduction in pesticide use and acute pesticide poisoning.<sup>21</sup>

Educating farmers appears compelling, but there are associated challenges. One is determining whether actual changes in practice occur, and if they do, how long these changes are sustained. Second, there is still the question of how to address poisoning after it has already occurred. Education, like restrictive bans and safe storage practices, address prevention but do not

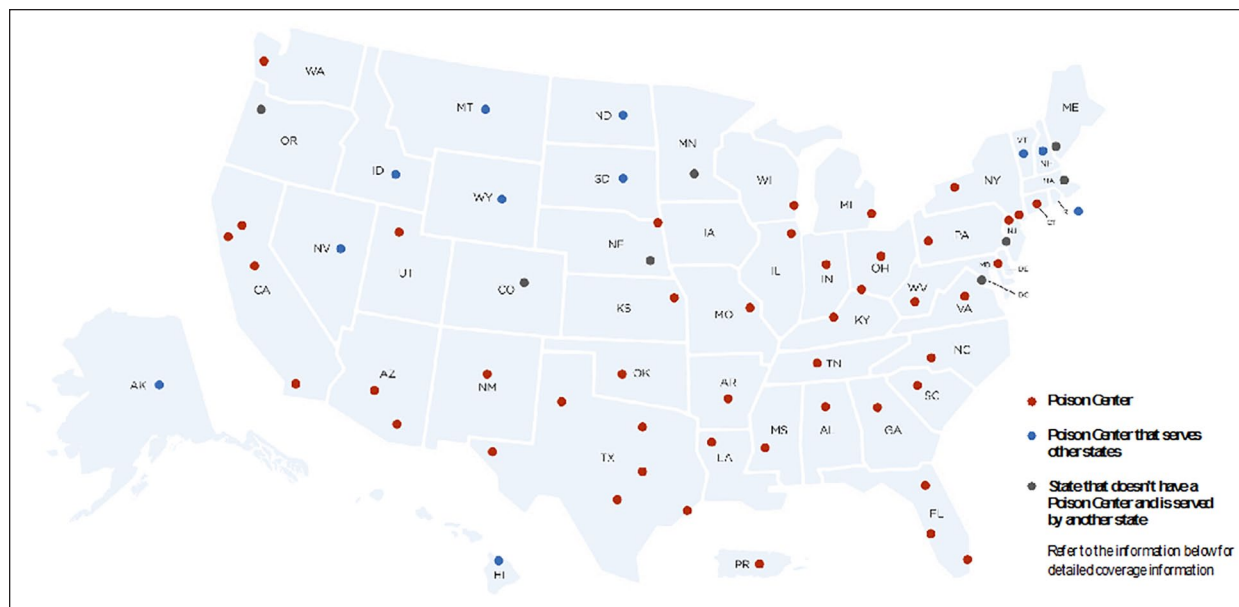


**Figure 1.** Map of Poison Control Centers in India (from World directory of poison centres<sup>24</sup>).  
Source: The World Health Organization (WHO) <https://apps.who.int/poisoncentres/>.

adequately address acute treatment of poisoning. Finally, it is unclear how such programs will affect the pediatric population. The hope is that educating farmers who use pesticides will lead to fewer incidents of acute pesticide poisoning via accidental exposure in the pediatric population.

**Policy option #3: Establish more poison control centers.** Establishing more dedicated regional poison control and treatment centers has been suggested as an important step toward the management of poisoning in India.<sup>8,18</sup> There is certainly a compelling argument to be made for increasing the number of poison centers in India as 4 of the studies cited in this paper came from 1 poison center: the NPIC in New Delhi.<sup>5-8</sup> Another study from a poison center in Gujarat—though it did not give a breakdown of pesticide poisoning by age—found that 35% of cases studied were for patients under the age of 16.<sup>18</sup> According to the World Health Organization, a “poisons cent[er] is a specialized unit that advises on, and assists with, the prevention, diagnosis and management of poisoning.”<sup>22</sup> There are currently only 7 poison centers in India,<sup>23</sup> which is inadequate to meet the needs of the entire country.<sup>18</sup> As a comparison, the United States has 55 regional poison control centers serving a population 1 quarter the size of India). Yet poison centers provide certain advantages over restrictions on pesticides or education. Because poison centers are able to dispense expert information, patients and healthcare providers can receive guidance on management and when indicated, antidote therapy for any acute poisoning. Moreover, the thousands of phone calls that poison centers like NPIC receive allow for active surveillance





**Figure 2.** Map of Poison Control Centers in the United States (from Poison centers<sup>25</sup>).

Source: <https://poisonhelp.hrsa.gov/sites/default/files/poisonhelp/resources/poison-centers-map.pdf>.

**Table 1.** Summary of Recommended Policies. (this is just a summary of policies created by the authors based on review of the literature)

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Restrict access to and Properly Store Pesticides
Ban most Deadly Pesticides
Educate Those Who Use Pesticides
Establish More Regional Poison Control Centers
Improve Health Infrastructure with EMS, ICUs, Ventilators, PPE, and Proper Antidotes

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**Table 2.** Most Common and Toxic Pesticides in Children. (adapted from Roberts et al<sup>26</sup>)

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Insecticides: Organophosphates, Organochlorines, Carbamates, Pyrethroids
Herbicides: Paraquat, Diquat, Glyphosate
Rodenticides: Aluminum/Zinc Phosphides, Warfarin Analogs (Brodifacoum), Bromethalin, Cholecalciferol

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**Table 3.** Summary of Why Children are Poisoned with Pesticides. (adapted from Roberts et al<sup>26</sup>)

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Neonates: Maternal-fetal Environmental Exposure
Young children and toddlers: accidental ingestion, environmental exposure (dermal and inhalational)
Adolescents: intentional ingestion for self-harm and suicides; accidental environmental exposure

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and data collection on emerging toxicological threats. Pesticides are not the only toxins that affect children in India, and poison centers with active management and

data collection can further inform areas where changes in policy and education may be needed. Poison centers are challenging to establish though, and the resources, personnel, and expertise required to run a 24/7 poison center can be significant.

### Conclusion

Pesticide poisoning is a decades-old problem in the pediatric population in India that remains a significant cause of morbidity and mortality today. Intentional pesticide poisoning as a means to commit suicide has garnered significant attention in India while younger children for the most part have been disregarded. A lack of quality data makes it difficult to properly inform policymakers on next steps; however, there are a few options that are reasonable in light of what is known. Reducing access to pesticides and educating farmers and the public regarding the proper storage and use of pesticides can be part of a broader strategy to address these poisonings in children. But the success of any strategy is dependent on a sustainable mechanism that is also able to address the paucity of data on poisoning, management of acute poisoning, and emerging toxicological threats. This can be accomplished with the establishment of more poison centers. To this end, a new poison center is currently being developed at MS Ramaiah University, in Bengaluru (population 8M) with the goal of providing expert toxicological information, multispecialty services for management of acute poisoning, and access to such services for the entire

state of Karnataka<sup>27</sup> (population 64M). Such centers may be able to significantly reduce the incidence of pesticide poisoning for children and adults alike and equip India with the capacity required to reduce accidental and intentional poisonings of all kinds.

### Author Contributions

Prinston Varghese: lead author, literature search, data interpretation, writing

Timothy B. Erickson: writing, literature search, data interpretation, editing, senior author mentorship

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### References

1. WHO. *Preventing Suicide: A Global Imperative*. World Health Organization; 2014.
2. Patel V, Ramasundarahettige C, Vijayakumar L, et al. Suicide mortality in India: A nationally representative survey. *Lancet*. 2012;379(9834):2343-2351. doi:10.1016/S0140-6736(12)60606-0. <http://www.ncbi.nlm.nih.gov/pubmed/22726517>
3. Vijayakumar L, Jeyaseelan L, Kumar S, Mohanraj R, Devika S, Manikandan S. A central storage facility to reduce pesticide suicides—a feasibility study from India. *BMC Public Health*. 2013;13(1):850. doi:10.1186/1471-2458-13-850. <https://www.ncbi.nlm.nih.gov/pubmed/24041373>
4. Mohanraj R, Kumar S, Manikandan S, Kannaiyan V, Vijayakumar L. A public health initiative for reducing access to pesticides as a means to committing suicide: findings from a qualitative study. *Int Rev Psychiatry*. 2014;26(4):445-452. doi:10.3109/09540261.2014.924094. <https://www.ncbi.nlm.nih.gov/pubmed/25137110>
5. Peshin SS, Srivastava A, Halder N, Gupta YK. Pesticide poisoning trend analysis of 13 years: A retrospective study based on telephone calls at the national poisons information centre, all India institute of medical sciences, New Delhi. *J Forensic Leg Med*. 2014;22:57-61. doi:10.1016/j.jflm.2013.12.013
6. Srivastava A, Peshin SS, Kaleekal T, Gupta SK. An epidemiological study of poisoning cases reported to the National Poisons Information centre, all India institute of medical sciences, New Delhi. *Hum Exp Toxicol*. 2005;24(6):279-285. doi:10.1191/0960327105ht527oa
7. Gupta SK, Peshin SS, Srivastava A, Kaleekal T. A study of childhood poisoning at national poisons information centre, all India institute of medical sciences, New Delhi. *J Occup Health*. 2003;45(3):191-196. doi:10.1539/joh.45.191. <https://jlc.jst.go.jp/DN/JALC/00210094073?from=SUMMON>
8. Peshin SS, Gupta YK. Poisoning due to household products: A ten years retrospective analysis of telephone calls to the national poisons information centre, all India institute of medical sciences, New Delhi, India. *J Forensic Leg Med*. 2018;58:205-211.
9. Buch NA, Ahmed K, Sethi AS. Poisoning in children. *Indian Pediatr*. 1991;28:521-524.
10. Khare M, Bhide M, Ranade A, Jaykar A, Panicker L, Patnekar PN. Poisoning in children—analysis of 250 cases. *J Postgrad Med*. 1990;36(4):203-206. <https://www.ncbi.nlm.nih.gov.proxy.cc.uic.edu/pubmed/2132245>
11. Singh UK, Chakraborty B, Prasad R. Aluminium phosphide poisoning: A growing concern in pediatric population. *Indian Pediatr*. 1997;34(7):650-651. <https://www.ncbi.nlm.nih.gov/pubmed/9401264>
12. Dutta AK, Seth A, Goyal PK, et al. Poisoning in children: Indian scenario. *Indian J Pediatr*. 1998;65(3):365-370. doi:10.1007/BF02761129. <https://www.ncbi.nlm.nih.gov/pubmed/10771987>
13. Sharma A, Dishant Gupta V, Kaushik JS, Mittal K. Aluminum phosphide (celphos) poisoning in children: a 5-year experience in a tertiary care hospital from northern India. *Indian J Crit Care Med*. 2014;18(1):33-36. doi:10.4103/0972-5229.125434. <https://www.ncbi.nlm.nih.gov/pubmed/24550611>
14. Ram P, Kanchan T, Unnikrishnan B. Pattern of acute poisonings in children below 15 years – A study from mangalore, south india. *J Forensic Leg Med*. 2014;25:26-29. doi:10.1016/j.jflm.2014.04.001. <https://www.clinicalkey.es/playcontent/1-s2.0-S1752928X1400064X>
15. Nandi DN, Mukherjee SP, Banerjee G, Boral GC, Chowdhury A, Bose J. Is suicide preventable by restricting the availability of lethal agents? A rural survey of West Bengal. *Indian J Psychiatry*. 1979;21:251-255.
16. Gunnell D, Knipe D, Chang S, et al. Prevention of suicide with regulations aimed at restricting access to highly hazardous pesticides: a systematic review of the international evidence. *Lancet Glob Health*. 2017;5(10):e1037. doi:10.1016/S2214-109X(17)30299-1. <https://www.sciencedirect.com/science/article/pii/S2214109X17302991>
17. Srinivas Rao C, Venkateswarlu V, Surender T, Eddleston M, Buckley NA. Pesticide poisoning in South India: Opportunities for prevention and improved medical management. *Trop Med Int Health*. 2005;10(6):581-588. doi:10.1111/j.1365-3156.2005.01412.x
18. Sharma S, Dewan A, Singh G. Toxicovigilance – an inevitable prerequisite to keep a watch on toxins around you. *J Forensic Leg Med*. 2016;45:32-35. doi:10.1016/j.jflm.2016.11.005. <https://www.clinicalkey.es/playcontent/1-s2.0-S1752928X1630155X>

19. Dewan A, Bhatnagar VK, Mathur ML, et al. Repeated episodes of endosulfan poisoning. *Clin Toxicol*. 2004; 42(4):363-369. doi:10.1081/CLT-120039542. <https://www.ncbi.nlm.nih.gov/pubmed/15461244>
20. Sam K, Andrade H, Pradhan L, et al. Effectiveness of an educational program to promote pesticide safety among pesticide handlers of south india. *Int Arch Occup Environ Health*. 2008;81(6):787-795. doi:10.1007/s00420-007-0263-3. <https://www.ncbi.nlm.nih.gov.proxy.cc.uic.edu/pubmed/17962973>
21. Mancini F, Jiggins JL, O'Malley M. Reducing the incidence of acute pesticide poisoning by educating farmers on integrated pest management in south india. *Int J Occup Environ Health*. 2009;15(2):143-151. doi:10.1179/oeh.2009.15.2.143. <https://www.narcis.nl/publication/RecordID/oai:library.wur.nl:wurpubs%2F396135>
22. Poisons centres. World Health Organization Web site. <https://www.who.int/ipcs/poisons/centre/en/>.
23. Poisons centres. World Health Organization Web site. [https://www.who.int/gho/phe/chemical\\_safety/poisons\\_centres/en/](https://www.who.int/gho/phe/chemical_safety/poisons_centres/en/). Updated 2017.
24. World directory of poison centres. World Health Organization Web site. <https://apps.who.int/poisoncentres/>
25. Poison centers. Health Resources and Services Administration Web site. <https://poisonhelp.hrsa.gov/sites/default/files/poisonhelp/resources/poison-centers-map.pdf>
26. Roberts JR, Karr CJ; Council on Environmental Health. Pesticide exposure in children [published correction appears in *Pediatrics*. 2013 May;131(5):1013-4]. *Pediatrics*. 2012; 130(6):e1765-e1788. doi:10.1542/peds.2012-2758
27. Erickson TB, Wahl M, Hryhorczuk D, et al. Implementation of an integrated multispecialty poison-control centre in Bangalore, India: Results of a pilot implementation. *Lancet Glob Health*. 2017;5(S1):S20. doi:10.1016/S2214-109X(17)30127-4. <https://www.clinicalkey.es/playcontent/1-s2.0-S2214109X17301274>