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## REVIEW ARTICLE

# UNINTENTIONAL CHILDHOOD POISONING, EPIDEMIOLOGY AND STRATEGIES FOR THE PREVENTION AND POLICY CHANGE IN PAKISTAN

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Poisoning is the fifth leading cause of unintentional injuries among young children. Agents most commonly ingested by young children include medicines, cleaning substances, hydrocarbons, pesticides and cosmetics. Children with less educated fathers, living in more crowded conditions and from lower income families are more predisposed to unintentional poisoning. Unsafe storage of medicines, chemicals and other hazardous substances is one of the leading reasons for childhood poisoning. Knowledge of parents and caregivers about prevention of poisoning may be the basis to prevent subsequent injuries. This paper is a review of the epidemiology of unintentional poisonings among young children (less than five years) and its risk factors especially in the context of Pakistan.

**Keywords:** Unintentional Poisoning, Review, Prevention, Pakistan

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## What is Unintentional Poisoning?

“An 11 month toddler enters the kitchen, roaming and exploring the floor found a soft drink bottle in the corner. He opened the loose closure and ingested some amount. It was kerosene. His mother immediately induced vomiting. After 4 days he developed Aspiratory Pneumonia.”

Such incidents are very common and may lead to significant morbidity and mortality. Poisoning is the fifth leading cause of unintentional injuries among young children.<sup>1</sup> These children are extremely vulnerable to unintentional poisoning as they are notorious for their curiosity and hand to mouth activity. Even after implementation of the Poison Prevention Packaging Act of 1970, poisoning continues to be a leading cause of injury-related hospitalization among toddlers in the US.<sup>2</sup> More than 1.1 million unintentional poisonings cases of children aged 5 and less are still reported to Poison control centres annually. The mortality rate in South Asia for poisoning is 5.47 per 100000 while a population based study from Pakistan reported an annual incidence of 4.3% for unintentional poisoning<sup>3</sup> cases<sup>4</sup>.

This paper is a review of the epidemiology of unintentional poisonings among young children (less than five years) and its risk factors especially in the context of Pakistan. The information is critical for designing cultural specific intervention strategies to reduce morbidity and mortality resulting from unintentional poisonings in children.

The majority of unintentional poisoning cases among young children occurred at home, with the kitchen being the commonest place of all followed by bedroom and bathroom. Handbags,

fridges, and shelves or ledges in the bathroom were the most unsafe places to store medications.<sup>5</sup> The bedroom was the most frequent place to get injured while the poisoning hazard was greatest in the kitchen as toddlers were left alone in the kitchen more commonly than in other rooms.

Agents most commonly ingested by young children include medicines, cleaning substances, hydrocarbons, pesticides and cosmetics.<sup>6,7</sup> The rate of ingestion was particularly high in the morning hours when the children were at play in the house. Organ system injury was the most severe and common consequence of poisoning. Studies document that more than half of the poisonings resulted from oral prescription drugs placed in non-child resistant containers. These drugs which had been originally dispensed in conventional non-child-resistant packages and later transferred to other containers.<sup>8</sup>

## Common Risk Factors:

Few epidemiological studies are available from Greece<sup>9</sup>, Malaysia<sup>10</sup>, Thailand<sup>11</sup>, and Pakistan<sup>7</sup> to date that identified factors associated with unintentional poisoning among children less than 5 years of age. The cohort study from Greece found an increased risk for children with less educated fathers, living in more crowded conditions and from lower income families.<sup>12</sup> A population based study from southern Brazil recognized that domestic and home environmental factors like socio-economically deprived and low level of maternal education increases the risk of unintentional injuries in early childhood.<sup>13</sup> Household factors like demographic status, house structure, family type as nuclear, low income, greater number of siblings and previous poisoning incidents are the major determinants.

Living in households with poor storage practices, with other young siblings greater than three<sup>14,15</sup> and unawareness about injury prevention are important factors. It has been reported that accidental poisoning in children usually occurs when hazardous substances are in use. Along with this presence of medicinal and tobacco users at home increases the risk of incidences.<sup>16</sup>

According to hospital base study conducted in Northern India that analyzed 20 years of hospital records (1970–1989) identified that in both decades, half of children belonged to middle income group followed by lower income group and least to upper income group.<sup>17</sup> This reflects probably better living environment and greater awareness of injury prevention in upper income class.

Unsafe storage, i.e., storing at height of less than two meters and at accessible places for young children, and unlocked storage of common household chemicals, medicines and cigarettes are other determinants of childhood poisoning.<sup>7,18,19</sup> Few epidemiological studies have been done to see the storage practices of poisonous substances in households where young children lived. Beirens *et al* conducted a cross sectional survey in Netherlands in 2004 and reported that 98% of toddlers were exposed to poisoning by medicines and 99% were exposed to poisoning by household chemicals. In a recent study, surveillance data from developing countries showed that only 30% parents of accidentally poisoned children, reported safe storage of hazardous substances at home. Two population based studies conducted in Palestine and United States showed that the storage areas of chemicals and medicines were quite different but they were suboptimal and within easy access of children.<sup>20,21</sup>

Hamid Soori *et al* conducted a case control study and showed that, children with previous poisoning experience were at increased risk for subsequent poisoning.<sup>22</sup> Knowledge of parents about prevention of poisoning and appropriate practices following the poisoning incidents may be the basis to prevent subsequent injuries.<sup>23</sup>

Larger family size or children with multiple siblings are at increased risk for unintentional poisoning. A study conducted in Jerusalem that mainly focused on overall unintentional injuries among children, revealed that the risk for accidents increased among children from families with four or more children as there were more children in the family who could accidentally cause injury to one another.<sup>24</sup> Another study conducted in Jordan,<sup>25</sup> found that 57% of children due to unintentional poisoning came from larger sized families. Chatsantiprapa *et al* conducted a case control study in

Thailand that focused on psychosocial factors of accidental poisoning in children<sup>11</sup>, identified that the youngest or second youngest were more liable to accidents owing to their younger age and lack of supervision by an adult as mothers were dependent on elder siblings to take care of younger ones.

Childhood behaviour is identified to be an important factor for unintentional poisoning. Curiosity and exploring nature of children makes them vulnerable in and around the home. Children with behaviour issues like hyperactivity and aggressiveness are comparatively reported more to be associated with unintentional poisoning.

#### **Prevention Strategies and Policies:**

The poison prevention among young children is almost always modifiable.<sup>26</sup> Generally the injury prevention strategies are classified into three types: Education, Engineering and Environmental modification, and Legislative interventions.

“Education” is considered in a wider context than merely “health education”. Education based initiatives reduce childhood injuries in general population.<sup>27</sup> Poison prevention programs should be integrated in all well-baby clinics in such a manner that parents and caretakers are counselled for how to poison-proof their child’s environment, even before a child is mobile.<sup>28</sup> Primary caregivers should be aimed as part of educational campaigns on child safety issues, while first-time pregnant mothers should be given injury prevention information at antenatal visits in primary healthcare centre, or in the antenatal or postnatal wards.<sup>29</sup>

Child-resistant packaging (CRP) has proven to be an effective intervention for toddlers’ leading to a reduction of more than 40% in the number of reported ingestions of hazardous products.<sup>2,5</sup> The distribution of child resistant containers was found to be both effective and cost-effective for poisoning prevention.<sup>30</sup> CRP includes both non-re-closeable and re-closeable packaging. CRP needs to undergo careful testing to be categorized as child-resistant. Such containers are not child-proof and in some cases may serve to delay the time it takes to open them, providing time for adult intervention.<sup>5</sup> Thus, parents and caregivers should always be encouraged to keep toxic substances out of the reach of children; even if they are in CRP.<sup>31</sup> Legislation in combination with health education can help to reduce the burden of injuries in developing countries.<sup>32</sup> Still poisoning continues to be a leading cause of injury related hospitalization among preschoolers, even after implementation of the Poison Prevention Packaging Act of 1970.<sup>2</sup> The Injury Prevention Program of the American Academy of Paediatrics (AAP) recommends that poisonous substances should be kept out of children’s sight and reach. Medicines and

household products should be purchased in childproof packages as often as possible and that the safety caps should always be immediately replaced after use.<sup>20</sup> AAP also recommends that all medicines, household products, and personal care products are stored in locked cabinets.<sup>20</sup> Caregivers should be aware of medicines and potentially poisonous substances that are stored in the house.<sup>20</sup> Parents with a lower educational background and mothers who don't have jobs are more prone to store products in a safe manner. The possible reason for this is that these mothers spend more time with their children at home and are more aware of the improper storage of possibly poisonous substances.

"Mr. Yuk" poison warning stickers, is another poison prevention strategy for toddlers. These stickers were designed to be placed on hazardous substances to discourage the children from handling the containers or ingesting the poison.<sup>2</sup> Syrup of *ipecac* and activated charcoal is not recommended by AAP & American Academy of Clinical Toxicology.<sup>2,6</sup> It is often administered when it is contraindicated or not necessary, and as a result uncontrollable vomiting follows that prohibits the use of other orally administered poison treatments, such as acetylcysteine.<sup>2</sup>

Injury prevention for preschool children relies heavily on making their environment safer. This includes actions to improve hazardous environments, and educating children and families on injury prevention. Information based strategies; such as community programs, clinic-or office-based counselling and regional poison control centres should be supported. Modifying the environment using health-promotion interventions can have a major impact on the global prevalence of this problem.<sup>31,33</sup>

#### Poison Prevention Packaging Act:

The Poison Prevention Packaging Act (PPPA) was approved to protect children from unintentional poisonings resulting from ingestion of hazardous household substances in the US. The PPPA authorized the US Consumer Product Safety Commission (CPSC) to order the use of special child-resistant packaging for toxic substances used in or around the home. PPPA defined child-resistant packaging as; that is "difficult for children under age five years to open" but "not difficult for normal adults to use properly".<sup>8</sup>

Oral prescription drugs thus became subject to child-resistant packaging requirements. The mortality rate from unintentional poisoning declined from about 3.5 deaths per million children in the late 60's to less than 2.0 deaths per million children in the early 90s.

The annual child mortality rate decreased by an estimated 1.40 deaths per million children younger than 5 years, following the 1974 child resistant packaging requirements.<sup>8</sup>

#### Strategies to Create Awareness in the Society:

Media and public education on acute childhood poisonings is necessary. Enforcement of the existing legislation relating to the control of medicines is one of the legal approaches that can be used. Storekeepers, pharmacists, dispensing doctors, and nurses should be encouraged to advise patients and caregivers on the safe use and storage of medicines and other chemicals.<sup>34</sup> The elderly need to be aware of risks of accidental ingestions of their drugs by children. A key educational role in this regard can be played by pharmacists and dispensing physicians, especially for drugs dispensed in non-child resistant packaging.<sup>35</sup>

#### Home Visitation Programs:

A multi-component Home Visitation Program (HVP) effectively reduced household hazards associated with poisoning among children in a low-income South African setting. HVP is without question an effective strategy as the three E's of WHO 2006 report; Education, Enforcement and Engineering are incorporated that reduce the household hazards. The intervention aims at changing the environment (home) through the promotion of a combination of passive and active measures. The passive strategies are known to be more effective than active preventive strategies as parental vigilance is demanded by active measures. HVP establishes continuing contact between the visitor and caregiver, encouraging the caregiver to take up safety practices and devices. In the Engineering phase of HVP a plastic container for storage of Paraffin with a childproof cap and warning label was used for safe storage of poisonous substances. Such measures are however insufficient to influence the long-term adoption of home safety measure.<sup>36,37</sup>

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