ACUTE CHILD POISONING AND ITS RELATED RISK FACTORS DURING THE COVID ERA

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ABSTRACT

Background: Poisoning is an important emergency in pediatric age groups throughout the world. The causes and types of poisoning vary from place to place in the world and even within the same country, also depending upon factors such as education, demography, socioeconomic factors, customs, and local belief. Aim of this study: To determine the frequency, etiology, characteristics, clinical presentation, and outcome of acute poisoning in children presenting to the National Environmental and Clinical Toxicological Research Center (NECTR), Cairo University. Participants and Methods: The current study is a prospective cross-sectional study, conducted on 240 pediatric patients (under 18 years old) who presented with acute poisoning to National Environmental and Clinical Toxicological Research Center (NECTR), Cairo University over three months during the COVID episode. Data were statistically analyzed for: demographic data of the participating children, manner of toxicity, place of exposure, type of poison, its availability to the child, the form of poison, duration between exposure and presentation, and the first aid that may be done to the child. Also, the severity and mortality rate detected by poison severity scoring (PSS) and rate of admission to the center or ICU and outcome were analyzed. Results: The current study showed that the long stay-at-home and school absence during COVID episodes may cause an increased risk of pediatric poisoning with household poisons and medications even in educated families. Also, accidental toxicity (84.6%) is still more common than intentional toxicity (15.4%), with negligence being the most significant probable precipitating factor. The incidence significantly increased in children with educated worker fathers and in cases where only the mother is accompanying the children. In addition, the risk for ICU admission was significantly higher (51.4%) in adolescents (13 to <18 years) with intentional poisoning. Conclusion: Pediatric poisoning is an emergency condition with younger children (< 9 yrs.) are highly susceptible to accidental exposure, however, with older ages (9 to <18 years), the incidence of intentional poisoning and risk of bad outcome increases. Keywords: Pediatric age, child poisoning, Manner of toxicity, COVID, Cairo, Poison severity scoring and Admission and outcome

INTRODUCTION

A poison is a substance that can cause organ dysfunction when ingested, inhaled, or taken by any route, leading to injury or death, and has the potential for adverse effects whether clinically apparent or not (Lee et al., 2019).

Poisoning represents one of the leading causes of morbidity and mortality worldwide. The problem is getting worse with time as newer drugs and chemicals are developing. Poisoning cases are increasing day by day due to changes in lifestyle and social behavior (Berta et al., 2020). The exact number of incidences may be higher than estimated because many poisoning cases go unreported (Omer, 2020).

Acute poisoning causes frequent presentations to emergency services, and its manner differs according to age. Accidental poisoning is common among children and leads to increased childhood morbidity and mortality. Adults do also get poisoned but through intentional poisoning that could be a suicidal attempt (Mintegi et al., 2017).

Accidental exposure to a toxic substance by a young child represents a complex interplay of host, agent, and environmental factors (Baqir et al., 2017). Pediatric poisoning cases are on the increase due to rapid industrialization, increased variety of health products, lack of adequate parental supervision, and increased media viewing (Shirkosh et al., 2019).
Child poisoning became a significant component of injury-related morbidity and mortality, so detecting poisoning patterns and manner would help to identify the risk factors and allow early diagnosis and management of such cases, therefore reducing morbidity and mortality (Mahmoud, 2019).

While the world is facing a major pandemic situation, the COVID-19 outbreak, the risk of child poisoning is increasing due to restrictions and school closure making young children at home for a longer time and thus more exposed to poisons. In addition, disproportionate fear of COVID infection leads to dramatic behavior modification, such as misuse of cleaning products for personal hygiene or food cleaning and excessive house cleaning, making child exposure to these poisons more frequent (Le Roux et al., 2020).

Aim of this study: To determine the frequency, etiology, characteristics, clinical presentation, and outcome of acute poisoning in children presenting to the National Environmental and Clinical Toxicological Research Center (NECTR), Cairo University

**PARTICIPANTS AND METHODS**

This is a prospective cross-sectional study, conducted on 240 pediatric patients (under 18 years old) presented and admitted to the National Environmental and Clinical Toxicological Research Center (NECTR), Cairo University, for three months (from the beginning of July to end of September 2020) with a proper history of acute toxicity or with symptoms and signs suggestive of possible poisoning (Le Roux et al., 2020).

Regarding the manner of toxicity, patients were classified into two groups:

- Group 1: Unintentional (accidental) toxicity.
- Group 2: Intentional (suicidal) toxicity.

The participants were classified into four groups depending on their age, according to Zisowsky et al., (2010):

- Group A: Infant and toddler (28 days to <3 yrs.).
- Group B: Early childhood (3 yrs. to <9 yrs.).
- Group C: Late childhood (9 yrs. to <13 yrs.).
- Group D: Adolescent (13 to <18 years).

Inclusion criteria:

1. Children (1 month to 18 years)
2. Both sexes.
3. History of recent exposure to a toxic substance, corrosive or adverse drug reaction, whether accidental or intentional
4. Or clinical features suggestive of possible poisoning
   - Exclusion criteria:
     1. Adults (above 18 years)
     2. History of chronic exposure
     3. Food poisoning
     4. Longstanding ill health of unknown etiology

   - **Methodology in detail:**
     All cases of suspected or confirmed acute poisoning in children (1 month to 18 years), would be prospectively analyzed by a cross-sectional analytic study. Cases were analyzed for:

     - Demographic data of the patients: age, sex, residence, level of education, and family status.
     - Primary data include:
       - Type of poison and its availability to the child
       - Form of poison.
       - Place of exposure.
       - Manner of toxicity.
       - The duration between exposure and presentation.
       - The first aid that may be done to the patient.
       - Associated morbidity.
       - History of medications
       - History of psychiatric diseases
     - Data concerning physical examination and investigations according to the different poisons:
       - CNS manifestation: alert, drowsy, coma, convulsion or hallucination.
       - Vital signs: normal, affected, or shocked.
     - Recorded investigations:
       - The routine investigation, done or not, and specific investigation, done or not.
     - Severity and mortality rate of each poison detected by poison severity scoring (PSS). The Poisoning Severity Score grades severity as (0) none, (1) minor, (2) moderate, (3) severe, and (4) fatal poisoning (Persson et al., 1998).
     - Data regarding lines of treatment:
       1. Methods of GIT decontamination: no decontamination done, gastric lavage with activated charcoal or activated charcoal only.
       2. Symptomatic treatment: not done, given at home, or given in the hospital.
       3. Antidote: the drug has no specific antidote and only supportive treatment was
given. Treatment was given in full regimen or given but the patient improved before the full regimen was completed. The patient was not admitted and no need for an antidote.

- The outcome of the case: Improved and discharged, discharged on his or her parent's responsibility, died, complicated, or the drug with no toxic effect.
- Admission: Admitted cases including patients admitted to ICU or observed for a certain period or not admitted.

Ethical approval:
The study was approved by the research ethical committee of the faculty of medicine, Cairo University (code: MS-231-2020)

Informed consent was taken from the child's legal guardian before participating in this study

Statistical analysis:
The data were analyzed using Microsoft Excel 2016 and the statistical package for social science 'IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, N.Y., USA). Continuous normally distributed variables were represented as mean ± standard deviation (SD) with a 95% confidence interval, while non-normal variables were summarized as median with 25 and 75 percentiles and using the frequencies and percentage for categorical variables; a p-value < 0.05 will be considered statistically significant. To compare the means of normally distributed variables between the two groups, the Student's t-test was performed, and the Mann-Whitney U test will be used in non-normal variables. To compare the means of normally distributed variables between groups, the ANOVA in multi groups was performed, and the Kruskal Wallis H test will be used in non-normal variables and χ² test or Fisher's exact test was used to determine the distribution of categorical variables between groups. Effect modifications were evaluated by stratification, and statistical interaction was assessed by including main predictor variables and their product terms in the binary logistic regression analysis in addition to multinomial logistic regression analysis. The Survival analysis was done by "Log Rank (Mantel-Cox) Kaplan-Meier test". To assess the risk of intensive care unit (ICU) admission, we used to admit cases to ICU as cases and non-admitted as controls to be able to assess the risk using logistic regression analysis.

RESULTS
In the current study, 240 children presented to the national institution and clinical and environmental toxicology, faculty of medicine, Cairo University, for three months from the start of July to the end of September 2020. There were no homicidal cases. Poisoning incidence was significantly higher among the youngest age group (Infants and toddlers below 3 years), and among children whose fathers were educated workers. In addition, poisoning was insignificantly more common in female children than males, and in urban areas than rural ones. Family negligence was the most significant higher poisoning risk factor, and Thursday was the most significantly day higher in case rate. (Table 1). In addition, accidental child poisoning inside the home was significantly higher than intentional and outside home poisoning, also medications and drugs were the most significant attributed poison (antipsychotic and non-steroidal anti-inflammatory drugs (NSAID) were the commonest used drugs), while cannabis was the most significant taken drug of abuse. Furthermore, significantly, most children (P= 0.001) didn't have any history of chronic medication, psychiatric disease, associated morbidities, or previous poison exposure (Table 2).

In the current study, the main significant clinical and laboratory presentations (P=0.001) for the majority of children were normal vital signs, normal Glasgow coma scale (GCS), normal oxygen saturation (>94%), normal reactive pupil, and normal random blood glucose (RBS).

Also, vomiting was the main significant presenting symptom (P=0.001) and the severity and mortality rate according to poison severity scoring (PSS) was minor in most cases (Table 3).

Regarding management and outcome, about 20% of cases needed no treatment, while the majority of cases were admitted warding and 17 % were admitted to ICU. Also, majority of cases significantly improved (P0.001) and needed only symptomatic and supportive management (Table 4).

The time interval between exposure to poison and the appearance of clinical symptoms was 0.50 - 12.0 hours (median 2 hours).
Table 1: Demographic data of participating children

|                          | Number | Percentage | P. value |
|--------------------------|--------|------------|----------|
| **Age***                 |        |            |          |
| Age Categories           |        |            |          |
| Infant and toddler       | 102    | 42.5       | 0.001**  |
| Early childhood          | 94     | 39.2       |          |
| Late childhood           | 9      | 3.8        |          |
| Adolescent               | 35     | 14.6       |          |
| **Sex**                  |        |            | 0.739    |
| Female                   | 116    | 48.3       |          |
| Male                     | 124    | 51.7       |          |
| **Residence**            |        |            | 0.096    |
| Rural                    | 100    | 41.7       |          |
| Urban                    | 140    | 58.3       |          |
| **Father Education**     |        |            | 0.037*   |
| Non educated             | 95     | 39.6       |          |
| Educated                 | 145    | 60.4       |          |
| **Father Work**          |        |            | 0.001**  |
| Not worker               | 46     | 19.2       |          |
| Worker                   | 194    | 80.8       |          |
| **Father Smoker**        |        |            | 0.211    |
| No                       | 135    | 56.3       |          |
| Yes                      | 105    | 43.8       |          |
| **Mother Education**     |        |            | 0.243    |
| Non educated             | 106    | 44.2       |          |
| Educated                 | 134    | 55.8       |          |
| **Mother Work**          |        |            | 0.134    |
| Not worker               | 138    | 57.5       |          |
| Worker                   | 102    | 42.5       |          |
| **Precipitating Factors**|        |            | 0.001**  |
| Family problems          | 32     | 13.3       |          |
| Father addiction         | 3      | 1.3        |          |
| Negligence               | 106    | 44.2       |          |
| Overactivity of baby     | 75     | 31.3       |          |
| Psychological problem    | 16     | 6.7        |          |
| Wrong medication         | 8      | 3.3        |          |
| **Who Is Accompanying the children** |        |            | 0.001**  |
| Mother                   | 159    | 66.3       |          |
| Father                   | 57     | 23.8       |          |
| Mother & Father          | 12     | 5.0        |          |
| Friends & Relatives      | 12     | 5.0        |          |
| **Day of Week**          |        |            | 0.004**  |
| Saturday                 | 15     | 6.3        |          |
| Sunday                   | 45     | 18.8       |          |
| Monday                   | 34     | 14.2       |          |
| Tuesday                  | 32     | 13.3       |          |
| Wednesday                | 24     | 10.0       |          |
| Thursday                 | 64     | 26.7       |          |
| Friday                   | 26     | 10.8       |          |
| **Time Spent In Hospital/Hrs*** | 1.0 - 192.0 | 6.0(3.0-24.0) | - |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant. The data were analyzed by X² test.
### Table 2: Poison characteristics and medical history of participating children

| Manner of Poison | Number | Percentage | P. value |
|------------------|--------|------------|----------|
| Accidental       | 203    | 84.6       | 0.001**  |
| Intentional      | 37     | 15.4       |          |

| Poison Site      | Number | Percentage | P. value |
|------------------|--------|------------|----------|
| In home          | 210    | 87.5       | 0.001**  |
| Out home         | 30     | 12.5       |          |

| Availability of Poison | Number | Percentage | P. value |
|------------------------|--------|------------|----------|
| Accessible surface     | 65     | 27.1       | 0.001**  |
| Buy it                 | 13     | 5.4        |          |
| Familiar bottle        | 23     | 9.6        |          |
| Father and mother's medication | 39   | 16.2       |          |
| Open cupboard          | 45     | 18.8       |          |
| Patient medication    | 15     | 6.3        |          |
| Used at home, everyone reaches it | 40  | 16.7       |          |

| Type of Poison | Number | Percentage | P. value |
|----------------|--------|------------|----------|
| Bite           | 4      | 1.7        | 0.001**  |
| Drug abuse     | 22     | 9.2        |          |
| Medication     | 99     | 41.3       |          |
| House cleaning | 63     | 26.3       |          |
| Pesticide      | 12     | 5.0        |          |
| Others         | 32     | 13.3       |          |
| Unknown        | 8      | 3.3        |          |

| Drug abuse | Number | Percentage | P. value |
|------------|--------|------------|----------|
| Cannabis   | 14     | 63.6       | 0.001**  |
| Ethyl alcohol | 3   | 13.6       |          |
| Tramadol   | 3      | 13.6       |          |
| Methanol   | 2      | 9.1        |          |

| Medication | Number | Percentage | P. value |
|------------|--------|------------|----------|
| Multidrug  | 13     | 13.13      | 0.001**  |
| NSAID      | 15     | 15.15      |          |
| Antipsychotic | 18   | 18.18      |          |
| Others     | 7      | 7.07       |          |
| Antidiabetic | 6    | 6.06       |          |
| Aminophylline | 9    | 9.55       |          |
| Anti Hypertensive | 4  | 4.04       |          |
| Paracetamol | 4     | 4.04       |          |
| Antiacid   | 5      | 3.05       |          |
| Antiepileptic | 3   | 3.03       |          |
| Antibiotic | 5      | 5.05       |          |
| Antitussive syrup | 6  | 6.06       |          |

| Route of Poison | Number | Percentage | P. value |
|-----------------|--------|------------|----------|
| Ingestion       | 234    | 97.5       | 0.001**  |
| Inhalation      | 2      | 0.8        |          |
| Venom           | 4      | 1.7        |          |

| History Medication | Number | Percentage | P. value |
|--------------------|--------|------------|----------|
| No                  | 221    | 92.1       | 0.001**  |
| Yes                 | 19     | 7.9        |          |

| Psychiatric History | Number | Percentage | P. value |
|---------------------|--------|------------|----------|
| No                   | 219    | 91.3       | 0.001**  |
| Yes                  | 21     | 8.8        |          |

| Associated Morbidity | Number | Percentage | P. value |
|----------------------|--------|------------|----------|
| No                    | 233    | 97.1       | 0.001**  |
| Yes                   | 7      | 2.9        |          |

| Previous Time | Number | Percentage | P. value |
|---------------|--------|------------|----------|
| No            | 209    | 87.1       | 0.001**  |
| Yes           | 31     | 12.9       |          |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant. The data were analyzed by X² test.
Table 3: Initial presentation to the emergency room and clinical assessment of participating children

|                          | Frequency | percentage | P. value |
|--------------------------|-----------|------------|----------|
| **Temperature**          |           |            |          |
| Normal                   | 232       | 96.7       | 0.001**  |
| Low                      | 2         | 0.8        |          |
| High                     | 6         | 2.5        |          |
| **Respiratory Rate**     |           |            | 0.001**  |
| Normal                   | 223       | 92.9       |          |
| Bradypnea                | 2         | 0.8        |          |
| Tachypnea                | 15        | 6.3        |          |
| **Heart Rate**           |           |            | 0.001**  |
| Normal                   | 223       | 92.9       |          |
| Low                      | 1         | 0.4        |          |
| High                     | 5         | 2.1        |          |
| Bradycardia              | 2         | 0.8        |          |
| Tachycardia              | 9         | 3.8        |          |
| **Blood pressure**       |           |            | 0.001**  |
| Normal                   | 238       | 99.2       |          |
| Hypertension             | 2         | 0.8        |          |
| **RBG**                  |           |            | 0.001**  |
| Normal                   | 232       | 96.7       |          |
| Low                      | 3         | 1.3        |          |
| Hyper                    | 5         | 2.1        |          |
| **Glasgow coma scale (GCS)** | Mean of GCS*** | 5.0 - 15.0 | 13.9±1.96 |
|                         | <15       | 67         | 27.9     |
|                         | =15       | 173        | 72.1     |
| **oxygen saturation**    | Mean of oxygen saturation | 77.0 - 99.0 | 96.3±2.72 |
|                         | <94       | 13         | 5.4      |
|                         | >94       | 227        | 94.6     |
| **Pupil**                |           |            | 0.001**  |
| Dilated                  | 2         | .8         |          |
| PPP                      | 14        | 5.8        |          |
| Reactive                 | 187       | 77.9       |          |
| Sluggish                 | 37        | 15.4       |          |
| **Associated Symptom**   | CNS symptoms (drowsiness) | 33 | 13.8 |
|                         | Distress  | 8          | 3.3      |
|                         | Vomiting  | 122        | 50.8     |
|                         | Others    | 8          | 3.3      |
| **Severity and mortality rate according (PSS score)** | None | 48 | 20.0 |
|                         | Minor     | 110        | 45.8     |
|                         | Moderate  | 68         | 28.3     |
|                         | Severe    | 11         | 4.6      |
|                         | Fatal     | 3          | 1.3      |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant. The data were analyzed by X2 test.

***Mean of GCS and Mean of oxygen saturation are represented as Mean ± SD
Table 4: Management and outcome of participating children

| History of first aid done to the patient | Frequency (n) | Percentage (%) | P. value |
|-----------------------------------------|--------------|----------------|----------|
| No                                      | 115          | 48             | 0.677    |
| Yes                                     | 125          | 52             |          |

| Admitted | Frequency (n) | Percentage (%) | P. value |
|----------|--------------|----------------|----------|
| No       | 44           | 18.3           | 0.001**  |
| Admitted to ward                          | 154          | 64.2           |          |
| Admitted to ICU                           | 42           | 17.5           |          |

| Antidote | Frequency (n) | Percentage (%) | P. value |
|----------|--------------|----------------|----------|
| Given but not completed                    | 6            | 3.3            | 0.001**  |
| Given in full regimen                      | 22           | 11.2           |          |
| No specific antidote only supportive      | 168          | 85.5           |          |

| Outcome | Frequency (n) | Percentage (%) | P. value |
|---------|--------------|----------------|----------|
| Improved| 182          | 92.8           |          |
| On-demand| 11          | 5.6            | 0.001**  |
| Died    | 3            | 1.6            |          |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant.

Regarding the Age Categories

In the current study, in younger age groups (infants and young children < 9 years), accidental poisoning was significantly predominant (100% in infants and toddlers (28 days to <3 yrs.) and 96.8% in young children < 9 years), while intentional poisoning was significantly higher in older ages (9 – 18 years) (P=0.001).

Furthermore, medical, psychiatric history, and previous poisoning conditions were significantly higher in C&D age groups (late childhood & Adolescent (9 – 18 years)) groups (Table 5).

In group A&B age categories when compared to other age categories; house cleaning agents significantly were the most common poisonings (Table 6).

Regarding management and outcome, in all age groups as shown in Table 6, there were no significant differences between age groups concerning the need for symptomatic treatment or ward admission, while a Significantly majority of adolescents were admitted to ICU (p=0.02) and their average hospital stay was longer than any other age groups (p=0.001). Infants and toddler were significantly presented with non-severity rate.

Table (5): Personal history and medical history in relation to children's age groups

| Infant and toddler n=102 | Early childhood n=94 | Late childhood n=9 | Adolescent n=35 | P. value |
|--------------------------|----------------------|-------------------|-----------------|----------|
| Sex                      |                       |                   |                 |          |
| F                        | 48(47.1%)             | 39(41.5%)         | 6(66.7%)        | 23(65.7%)| 0.06    |
| M                        | 54(52.9%)             | 55(58.5%)         | 3(33.3%)        | 12(34.3%)|          |

| Residence                |                       |                   |                 |          |
| Rural                    | 37(36.3%)             | 39(41.5%)         | 4(44.4%)        | 20(57.1%)| 0.2     |
| Urban                    | 65(63.7%)             | 55(58.5%)         | 5(55.6%)        | 15(42.9%)|          |

| Manner of Poison         |                       |                   |                 |          |
| Accidental               | 102(100.0%)           | 91(96.8%)         | 4(44.4%)        | 30(85.7%)| 0.001** |
| Intentional              | 0(0.0%)               | 5(55.6%)          |                 |          |

| History Medication       |                       |                   |                 |          |
| No                      | 101(99.0%)            | 87(92.6%)         | 4(44.4%)        | 26(74.3%)| 0.001** |
| Yes                     | 1(1.0%)               | 7(7.4%)           | 2(22.2%)        | 9(25.7%) |

| Psychiatric History      |                       |                   |                 |          |
| No                      | 102(100.0%)           | 91(96.8%)         | 4(44.4%)        | 26(74.3%)| 0.001** |
| Yes                     | 0(0.0%)               | 5(55.6%)          |                 |          |

| Previous Time            |                       |                   |                 |          |
| No                      | 97(95.1%)             | 83(88.3%)         | 5(55.6%)        | 24(68.6%)| 0.001** |
| Yes                     | 5(4.9%)               | 11(11.7%)         | 4(44.4%)        | 11(31.4%)|          |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant.

* Regarding the Age Categories

Regarding management and outcome, in all age groups as shown in Table 6, there were no significant differences between age groups concerning the need for symptomatic treatment or ward admission, while a Significantly majority of adolescents were admitted to ICU (p=0.02) and their average hospital stay was longer than any other age groups (p=0.001). Infants and toddler were significantly presented with non-severity rate.
Table (6): poison characteristics and outcome in relation to children age groups

| Type of Poison                  | Infant and toddler n=102 | Early childhood n=94 | Late childhood n=9 | Adolescent n=35 | P. value |
|--------------------------------|---------------------------|----------------------|--------------------|-----------------|----------|
| Bite                           | 1(1.0%)                   | 2(2.1%)              | 1(11.1%)           | 0(0.0%)         | 0.08     |
| Drug abuse                     | 11(10.8%)                 | 7(7.4%)              | 0(0.0%)            | 4(11.4%)        | 0.07     |
| House cleaning                 | 39(38.3%)                 | 27(28.7%)            | 1(11.1%)           | 1(2.9%)         | 0.05*    |
| Medication                     | 34(33.2%)                 | 38(40.4%)            | 4(44.4%)           | 18(51.4%)       | 0.1      |
| Pesticide                      | 6(5.9%)                   | 5(5.3%)              | 0(0.0%)            | 1(2.9%)         | 0.2      |
| Others                         | 8(7.8%)                   | 12(12.8%)            | 3(33.3%)           | 9(25.7%)        | 0.1      |
| Unknown                        | 3(2.9%)                   | 3(3.2%)              | 0(0.0%)            | 2(5.7%)         | 0.7      |

| Severity and mortality rate according (PSS score) | Infant and toddler n=102 | Early childhood n=94 | Late childhood n=9 | Adolescent n=35 | P. value |
|--------------------------------------------------|---------------------------|----------------------|--------------------|-----------------|----------|
| None                                             | 30(29.4%)                 | 17(18.1%)            | 1(11.1%)           | 0(0.0%)         | 0.04*    |
| Minor                                            | 43(42.2%)                 | 54(57.4%)            | 4(44.4%)           | 9(25.7%)        | 0.1      |
| Moderate                                         | 25(24.5%)                 | 17(18.1%)            | 4(44.4%)           | 22(62.9%)       | 0.05*    |
| Severe                                           | 3(2.9%)                   | 6(6.4%)              | 0(0.0%)            | 2(5.7%)         | 0.2      |
| Fatal                                            | 1(1.0%)                   | 0(0.0%)              | 0(0.0%)            | 2(5.7%)         | 0.7      |

| Admitted                                        | No                        | 21(20.6%)            | 16(17%)            | 2(22.2%)        | 5(14.3%)  | 0.08     |
|                                                 | Admitted to ward          | 71(69.6%)            | 66(70.2%)          | 5(55.6%)        | 12(34.3%) | 0.1      |
|                                                 | Admitted to ICU           | 10(9.8%)             | 12(12.8%)          | 2(22.2%)        | 18(51.4%) | 0.02*    |

| Outcome                                         | Improved                  | 100(98%)            | 91(96.7%)          | 9(100.0%)       | 26(74.3%) | 0.1      |
|                                                 | On-demand                 | 1(1.0%)             | 3(3.2%)            | 0(0.0%)         | 7(20.0%)  | 0.01*    |
|                                                 | Died                      | 1(1.0%)             | 0(0.0%)            | 0(0.0%)         | 2(5.7%)   | 0.3      |
|                                                 | Time Spent In Hospital/Hrs*** | 4.0(3.0-12.0)       | 6.0(3.0-7.5)       | 6.0(4.5-24.0)   | 24.0(6.0-24.0) | 0.001** |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant.

**Regarding the Manner of Poison**
Accidental poisoning was significantly more common in males than females while the reverse was true for intentional poisoning (p=0.001). Also, the age of those with intentional poisoning was significantly older than those with accidental poisoning (median age, IQR= 15 years, IQR: 13, 16) years, p=0.001.

In addition, medication and house cleaning agents were significantly (p=0.001) the most attributed poisons in accidental poisoning, while intentional poisoning was mainly through medications (64.9%) followed by pesticides (24.3%) (p=0.001). Furthermore, medical and psychiatric history and a previous history of poisoning were also highly significant (p=0.001) found in cases of intentional poisoning (Table 7). Regarding poison severity scoring (PSS), moderate and fatal PSS scores were more significantly found in cases with intentional poisoning (p=0.001 and p=0.03), while minor PSS and none were more common in accidental poisoning (p=0.001).

**Regarding management and outcome,** intentional poisoning was significantly more severe, and patients needed to be admitted (significantly ICU admission (45% compared to 12.4%, p=0.001)) and had more bad outcomes than accidental poisoning (Table 7).

**Risk assessment for ICU admission**
The risk for ICU admission was highly significant higher in adolescents (median age 10 years with ratio risk assessment 1.081(1.037-1.127) and children with intentional poisoning, and there was no significant difference in relation to sex or residence (Table 8). In addition, the Risk for ICU admission was highly significant higher in cases with poor vital signs (low temperature, GCS<15, O2 saturation ≤94%, and brady- or tachycardia), with CNS symptoms and moderate to severe PSS score. Furthermore, ICU admission was higher in medicinal and pesticide poisoning (Table 9).
DISCUSSION

The current study was a cross-sectional observational, convenience sampling, which included 240 children and adolescents presenting to the National Environmental and Clinical Toxicological Research Center (NECTR), Cairo University with acute poisoning. The mean age was 3.0 years with ages ranging from 0.58 to 18.0 years and the largest group was the infants and toddlers (102 patients, 42.5%) while the smallest group was that representing the late childhood group (9 patients, 3.8%) (p<0.001). This concurs with the findings of Azab et al., 2016, who related this to high levels of physical activity, particularly at two years of age who usually explore the environment around them, everything goes into their mouths and they lack awareness of potential dangers.

Males demonstrated a higher representation in our cases (51.7%), which is consistent with other studies (Azab et al., 2016; Even et al., 2014; Hassan and Siam, 2014). A male predominance is found among poison exposure victims younger than 13 years, but the sex distribution is reversed in teenagers due to greater levels of physical activity in this group, cultural norms sometimes result in less family supervision of male individuals leading to a higher possibility of accidents in this gender. Ramos et al., (2010) suggested that poisoning events in children result from the complex interplay of several factors related to the child, the toxic substance, the environment, family behavior, and/or access to health services.

In the current study, around 58.3% of the victims presented from urban areas, a similar finding was approved by the Egyptian study of El Masry and Azab, 2013. This may be because our centers are present in Cairo but also some agents causing poisoning may be more available in urban than rural areas. This result was in contrast with those of Hassan and Siam, 2014 who found a greater number of victims of poisoning in children presenting from rural areas. The difficulty and cost of transport to the cities as well as the lack of proper documentation of cases makes it difficult to estimate the real number of cases.

We found that 60% of the fathers in our study were educated. This figure is higher than that recorded by Azab et al., 2016, who collected their cases from the Poisoning Unit of a university hospital in Egypt from 2009 to 2016 before the COVID era. We think that the increase in poisoning incidence among educated families during the COVID era may be due to over-awareness about dangers and methods of infection control besides over fear of infection, which leads to misuse of chemicals and disinfectants.

One of the major factors contributing to childhood poisoning may be the mother’s absence during the day whether outside the home or engaged in household duties or attending to personal needs (Ahmed et al., 2020). In this study, we recorded an 80.8% employment level in the fathers of the study group compared to 42% in the mothers, which was similar to the findings by Azab et al., 2016.

Negligence was the most common factor resulting in poisoning, recorded in 44.2% of the study group (p<0.01), followed by the over-activity of the child (31%). Ramos et al., (2010), found that inattention by the parents was the primary cause.

On the weekend or around national or religious holidays, parents may be less alert to hazards or children may exhibit more attention-seeking behavior (Mansori et al., 2016; Urkin and Naimer, 2015).

In our study, Thursday was the most common day of the week for the presentation of cases with 26.7% recorded on this day (p<0.01) followed by Sunday (18.8% of cases) with Saturday being the day with the least presentation of cases (6.3%).
Table (7) Personal history, medical history, poison characteristics, and outcome in relation to the manner of poisoning

|                                | Accidental (203) | Intentional (37) | P. value |
|--------------------------------|------------------|------------------|----------|
| Age                            | 3.0(2.0- 4.0)    | 15.0(13.0-16.0)  | 0.001**  |
| Sex                            |                  |                  |          |
| F                              | 88(43.3%)        | 28(75.7%)        | 0.001**  |
| M                              | 115(56.7%)       | 9(24.3%)         |          |
| Residence                      |                  |                  | 0.3      |
| Rural                          | 82(40.4%)        | 18(48.6%)        |          |
| Urban                          | 121(59.6%)       | 19(51.4%)        |          |
| Type of Poison                 |                  |                  |          |
| Bite                           | 4(2.0%)          | 0(0.0%)          | 0.04*    |
| Drug abuse                     | 20(9.9%)         | 2(5.4%)          | 0.05*    |
| House cleaning                 | 63(31.0%)        | 0(0.0%)          | 0.001**  |
| Medication                     | 75(36.9%)        | 24(64.9%)        | 0.001**  |
| Pesticide                      | 23(11.3%)        | 9(24.3%)         | 0.001**  |
| History Medication             |                  |                  | 0.01*    |
| No                             | 194(95.6%)       | 27(73.0%)        |          |
| Yes                            | 9(4.4%)          | 10(27.0%)        |          |
| Psychiatric History            |                  |                  | 0.001**  |
| No                             | 197(97.0%)       | 22(59.5%)        |          |
| Yes                            | 6(3.0%)          | 15(40.5%)        |          |
| Previous Time                  |                  |                  | 0.001**  |
| No                             | 185(91.1%)       | 24(64.9%)        |          |
| Yes                            | 18(8.9%)         | 13(35.1%)        |          |
| Severity and mortality rate    |                  |                  |          |
| according (PSS score)          |                  |                  |          |
| None                           | 47(23.2%)        | 1(2.7%)          | 0.001**  |
| Minor                          | 99(48.8%)        | 11(29.7%)        | 0.001**  |
| Moderate                       | 46(22.7%)        | 22(59.5%)        | 0.001**  |
| Severe                         | 10(4.9%)         | 1(2.7%)          | 0.2      |
| Fatal                          | 1(0.5%)          | 2(5.4%)          | 0.03*    |
| Admitted                       |                  |                  |          |
| No                             | 36 (17.7%)       | 6 (16.3%)        | 0.001**  |
| Admitted to ward               | 153(75.4%)       | 14 (37.8%)       | 0.3      |
| Admitted to ICU                | 25(12.3%)        | 17(45.9%)        | 0.001**  |
| Outcome                        |                  |                  |          |
| Improved                       | 197(97 %)        | 29(78.4%)        | 0.01*    |
| On-demand                      | 5(2.5%)          | 6(16.2%)         | 0.001**  |
| Died                           | 1(0.5%)          | 2(5.4%)          | 0.03*    |

* p. value <0.05 is significant, ** p. value <0.01 is highly significant.
Table (8): Risk assessment for ICU admission for children in the studied groups in relation to demographic data and poison characteristics

|                                | Not Admitted N=198 | ICU Admission N=42 | OR(95%CI)          | P. value |
|--------------------------------|--------------------|--------------------|--------------------|----------|
| **Age**                        |                    |                    |                    |          |
| Infant and toddler             | 92(46.5%)          | 10(23.8%)          | 1.019(0.57 - 1.90) | 0.992*   |
| Early childhood                | 82(41.4%)          | 12(28.6%)          | 0.146(0.080 - 0.268) | 0.001**  |
| Late childhood                 | 7(3.5%)            | 2(4.8%)            | 0.286(0.059 - 1.375) | 0.2      |
| Adolescent                     | 17(8.6%)           | 18(42.9%)          | 9.741(3.843-24.694) | 0.001**  |
| **Sex**                        |                    |                    |                    |          |
| Females                        | 93(47.0%)          | 23(54.8%)          | 0.732 (0.375 - 1.428) | 0.3      |
| Males                          | 105(53.0%)         | 19(45.2%)          | 0.943 (0.481 - 1.848) | 0.2      |
| **Residence**                  |                    |                    |                    |          |
| Rural                          | 82(41.4%)          | 18(42.9%)          | 0.943 (0.481 - 1.848) | 0.2      |
| Urban                          | 116(58.6%)         | 24(57.1%)          | 0.943 (0.481 - 1.848) | 0.2      |
| **Manner of Poisoning**        |                    |                    |                    |          |
| Accidental                     | 178(89.9%)         | 25(59.5%)          | 6.052(2.801-13.074)  | 0.001**  |
| Intentional                    | 20(10.1%)          | 17(40.5%)          | 6.052(2.801-13.074)  | 0.001**  |
| **Type of Poison**             |                    |                    |                    |          |
| Bite                           | 3(1.5%)            | 1(2.4%)            | 0.333(0.035-3.205)  | 0.6      |
| Drug abuse                     | 16(8.1%)           | 6(14.3%)           | 0.975(0.147-0.958)  | 0.09     |
| Medication                     | 86(43.4%)          | 13(31.0%)          | 0.151(0.084-0.271)  | 0.001**  |
| House cleaning                 | 59(29.8%)          | 4(9.5%)            | 0.068(0.025-0.187)  | 0.001**  |
| Pesticide                      | 4(2.0%)            | 8(19.0%)           | 2.000(0.602-6.642)  | 0.01*    |
| Others                         | 24(12.1%)          | 8(19.0%)           | 0.933(0.150-0.742)  | 0.09     |
| Unknown                        | 6(3.0%)            | 2(4.8%)            | 0.333(0.067-1.652)  | 0.2      |

OR: Odds Ratio; CI: Confidence Interval; the data were analyzed by Logistic Regression analysis.
* p. value <0.05 is significant, ** p. value <0.01 is highly significant.
Table (9): Risk assessment for ICU admission for children in the studied groups in relation to initial presentation and clinical assessment

|                       | Not Admitted (198) | ICU Admission (42) | OR(95%CI)          | P. value |
|-----------------------|--------------------|--------------------|--------------------|----------|
| **Temperature**       |                    |                    |                    |          |
| Normal                | 197(99.5%)         | 35(83.3%)          | 0.178(0.124-0.255) | 0.01*    |
| High                  | 0(0.0%)            | 2(4.8%)            |                    | -        |
| Low                   | 1(0.5%)            | 5(11.9%)           | 5.000(0.584-42.797)| 0.001**  |
| **Respiratory Rate**  |                    |                    |                    |          |
| Normal                | 190(96.0%)         | 33(78.6%)          | 0.174(0.120-0.251) | 0.01*    |
| Bradypnea             | 0(0.0%)            | 2(4.8%)            |                    | -        |
| Tachypnea             | 8(4.0%)            | 7(16.7%)           | 1.875(0.317-2.413) | 0.01*    |
| **Heart Rate**        |                    |                    |                    |          |
| Normal                | 190(96.0%)         | 33(78.6%)          | 0.174(0.120-0.251) | 0.001**  |
| Bradycardia           | 0(0.0%)            | 4(9.5%)            |                    | -        |
| Tachycardia           | 8(4%)              | 4(9.5%)            | 1.800(0.215-2.979)| 0.03*    |
| **Blood pressure**    |                    |                    |                    |          |
| Normal                | 198(100.0%)        | 40(95.2%)          | 0.168(0.127-0.223)| 0.01*    |
| Hypertension          | 0(0.0%)            | 0(0.0%)            |                    |          |
| Hypotension           | 0(0.0%)            | 2(4.8%)            |                    |          |
| Glasgow coma scale    |                    |                    |                    |          |
| <15                   | 42(21.2%)          | 25(59.5%)          | 0.183(0.091-0.370)| 0.001**  |
| ≥15                   | 156(78.8%)         | 17(40.5%)          |                    |          |
| Oxygen saturation     |                    |                    |                    |          |
| <94%                  | 2(1.0%)            | 11(26.2%)          | 0.029(0.006-0.136)| 0.001**  |
| >94%                  | 196(99.0%)         | 31(73.8%)          |                    |          |
| **Associated Symptoms**|                   |                    |                    |          |
| No                    | 51(25.8%)          | 2(4.8%)            | 0.039(0.01-0.161) | 0.001**  |
| Burn                  | 3(1.5%)            | 2(4.8%)            | 0.667 (0.111 - 3.99)| 0.657   |
| CNS (Fits)            | 3(1.5%)            | 8(19.0%)           | 2.667(0.707-10.052)| 0.01*    |
| CNS (drowsiness)      | 21(10.6%)          | 12(28.6%)          | 2.571(1.281-4.161)| 0.001**  |
| Distress              | 5(2.5%)            | 3(7.1%)            | 0.6(0.143-2.511)   | 0.5      |
| Vomiting              | 108(54.5%)         | 14(33.3%)          | 0.13(0.074-0.226) | 0.001**  |
| Others                | 7(3.5%)            | 1(2.4%)            | 0.143(0.018-1.161)| 0.069    |
| **Severity and mortality rate (PSS score)** | | | | |
| None                  | 47(23.7%)          | 1(2.4%)            | 0.021(0.003-0.154)| 0.001**  |
| Minor                 | 107(54.0%)         | 3(7.1%)            | 0.028(0.009-0.088)| 0.001**  |
| Moderate              | 42(21.2%)          | 26(61.9%)          | 2.619(1.380-4.010)| 0.001**  |
| Severe                | 2(1.0%)            | 9(21.4%)           | 4.500(0.972-20.827)| 0.001**  |
| Fatal                 | 0 (0.0%)           | 3(7.1%)            | -                   | -        |

OR: Odds Ratio; CI: Confidence Interval; the data were analyzed by Logistic Regression analysis.
* p. value <0.05 is significant, ** p. value <0.01 is highly significant.

The time interval between exposure to poison and the appearance of clinical symptoms is an important window of opportunity during which actions to reduce the effect of the toxin...
can be performed so delay in presentation to the hospital may be serious (Peden, 2008). In our study, the time between exposure and hospital presentation ranged from 0.5-12hrs with a median (IQR) of 2.0 (2.0-3.0), similar to observations of Sarhan et al., (2018); and Shirkosh et al., (2019). This wide range may be due to the long distance between rural areas and poison centers or some patients who had received primary care in another healthcare facility before. Time spent in the hospital, in the current study, ranged from 1-192 hours with a median (IQR) of 6.0 (3.0- 24 hr), in contrast, Srinivasa et al., (2016) documented that majority of cases were hospitalized for 24-48 hours. Differences may stem from differences in the type of poisoning and individual characteristics of the victims.

The most common manner of poisoning in our patients was accidental (203 patients) with the intentional mode observed in only 37 patients. These findings were obvious in different previous studies (Azab et al., 2016; Mahmoud, 2019; Mendonça et al., 2016). We also recorded no homicidal cases; this agrees with the findings of Cavanagh, (2005), who reported that child homicide is rare occurring at a rate of 2 per 100,000 inhabitants globally, and is mainly associated with psychological problems in the caregivers.

Furthermore, it was noticed in this study that the majority of the poisoning incidents occurred at home (87.5%), this may be explained by the fact that homes are the main familiar place to children (Trangadia et al., 2016) and a large number occurred due to the availability of the poison on an accessible surface as found in our study with 65 patients. Ramos et al, (2010) identified a height of lower than 150cm for placement of the poison as being a risk factor for accidental poisoning in young children.

Medications were the most common types of poisoning, recorded in 41.3% of our cases followed by house cleaning agents (26.3%), these are the two most available poisons indoors that children can access and easily ingest them. This is in agreement with findings in middle and high-income countries (Peden, 2008). Also, these results go with a study conducted by Devaranavadagi et al., (2017), where household products and medications represented the majority of toxicity in children aged below 5 years. In a study conducted by Trangadia et al., (2016) in India, the main type of poison was kerosene followed by other household products and snakebites. In Yemen, the commonest cause of poisoning in children admitted to Aden University between 2013 and 2017 was kerosene, house cleaning agents followed by pesticides (Omer, 2020). The most common types of medication in our study were antipsychotic drugs (18% of cases) and non-steroidal anti-inflammatory drugs (15%), which mostly belonged to the parents and were in open storage. This was due to the presence of these drugs in the home with easily accessible to the children.

The oral route represented the highest percentage in our cases (97.5% or 234 patients) (p<0.01) which is similar to many previous studies (Hassan and Siam, 2014; Mahmoud, 2019). This is due to the greater ease of administering poisoning agents orally compared to other routes.

The majority of cases showed a minor PSS score (45.8%) especially in the accidental group and the least were fatal (1.3%). Moderate and fatal PSS scores were more commonly observed with intentional poisoning, and significantly, the majority of those with intentional poisoning cases needed ICU admission (45%) and a higher percentage died (p=0.03). This is in accordance with Mahmoud (2019), in Zagazig University Hospital.

In the current study, those who died were significantly older in age, and poisoned intentionally (p <0.05).

CONCLUSION
Pediatric poisoning is an emergency condition with younger children are highly susceptible to accidental exposure, however, with older ages, the incidence of intentional poisoning and risk of bad outcome increases.

The current study showed (when compared with older studies before 2019) that the long stay-at-home and school absence during COVID episode may cause an increased risk of pediatric poisoning with household poisons even in educated families.

RECOMMENDATIONS
Further studies are needed on larger samples and to compare between three periods (pre, during, and post) Covid era, so that we can add or establish new guidelines for poisoning prevention and management in such pandemic eras.
Declarations
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Conflict of Interest disclosure: the first author is an associate editor in the Egyptian journal of forensic sciences and applied toxicology.

Research ethics and patient consent: The study was approved by the research ethical committee of the faculty of medicine, Cairo University (code: MS-231-2020).
Informed consent was taken from the child's legal guardian before participating in this study.

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الملخص العربي
التسمم الحاد في الأطفال وعوامل الخطر المتعلقة به أثناء انتشار وباء كورونا

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2 قسم الأطفال- كلية الطب- جامعة القاهرة
3 مستشفى الأقصر العام- وزارة الصحة المصرية

يعتبر التسمم الحاد في الأطفال واحداً من أهم الحالات الطارئة التي يتعرض لها الأطفال في هذا العمر، وقد يكون له تأثيرات طويلة الأمد. تختلف أنواع التسمم والعوامل المؤثرة فيه من مكان لآخر ومن دولة لدولة، وفي نفس الدولة ذاتها.

وتتطلب معالجة التسمم في الأطفال على عوامل متعددة منها عوامل اجتماعية وديموغرافية ومستوى التعليم والمعتقدات والأفكار المختلفة.

تمت هذه الدراسة على 240 حالة اطفال تحت عمر 18 عاماً الذين تلقوا العلاج في المركز القومي للسموم الإكلينيكية والبيئية بجامعة القاهرة، وكانت مدة الدراسة ثلاثة أشهر في فترة الموجة الثانية لفيروس كورونا المستجد في مصر.

وتبين من هذه الدراسة أن التسمم بالخطأ مازال أكثر انتشاراً في الأطفال، مع ارتفاع المعدل الحاد إلى تلقى العلاج في النهاية المركز أكبر في الأطفال، هذا أدى إلى أن أجزاء كبيرة من الأطفال التي يتعرض لها السوسمปฏلاً للعلاج في المنزل.

وقد استنتجت هذه الدراسة أن التسمم في الأطفال من أخطر حالات الطوارئ خصوصاً في العمر الأكبر الذي يتناولون السموم عن عمداً مما يؤثر على حالاتهم الصحية وقد يؤدي للوفاة.