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General pattern of paediatric poisoning in Jordan during 2018–2019

Enas M. ALzayadneh [a], Kamal A. ALHadidi [b,d,*], Ihab Alasasfeh [c], Abdelkader Battah [b], Suhad M. Khasawneh [d], Madeha N. Faouri [e], Robina W. Diab [f], Yaqin M. Alzagareet [f], Noourlhuda H. Abbas [f], Renad H. Al-Debei [f], Ayah M. Zaqqa [f], Farah K. Hadidi [g], Layan M. Khraisat [g]

[a] Department of Paediatric, School of Medicine, the University of Jordan, Jordan
[b] Department of Pathology Microbiology and Forensic Medicine, School of Medicine, the University of Jordan, Jordan
[c] Department of Emergency-Jordan University Hospital, General Surgery Department, School of Medicine, the University of Jordan, Jordan
[d] Jordan Poison Information Center- Jordan University Hospital, Jordan
[e] Department of Pharmacy, School of Nursing, Al-Balqa' Applied University, Jordan
[f] School of Medicine, the University of Jordan, Jordan
[g] School of Medicine, the University of Jordan, Jordan

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ABSTRACT

Introduction: Acute accidental poisoning in children remains a significant public health issue and a predictable cause of morbidity around the world. To take preventive measures, it is necessary to identify the pattern of this problem.
Objective: To determine the extent and characteristics of paediatric poisoning, an epidemiological investigation specific to each country is required. The goal of our research was to determine the current pattern of acute poisoning in children between (0−5) years old in Jordan.
Methods: This retrospective study performs a descriptive analysis of the Jordan University Hospital's National Poison Information Center (NPIC) database and describes the epidemiology of acute poisoning in children between (0−5) years old during a period of two years (2018–2019).
Results: Paediatric poisoning (0−5) years old accounts for approximately 88% of poisoning cases in Jordan between 2018 and 2019.Out of 3531 paediatric poisoning cases, 44.9% of cases were in children between (2−3) years old, 63.4% of subjects were male. 40.9% of calls were from governmental hospitals. Most cases occurred at home (98.7%) and were unintentional (98.6%). Medication poisoning was the commonest among cases (71.0%). Besides, 89.4% were asymptomatic at the time of call, and Central Nervous System (CNS) symptoms being the most common (3.6%) among the symptomatic cases.
Conclusions: Most cases of paediatric poisoning handled by the NPIC was due to medications. To prevent or minimize these cases, it is necessary to educate parents and other caregivers about proper medication storage and use, and in case of poisoning, urgent referral to health facilities is required.

1. Introduction

Paediatric poisoning is a major public health concern that leads to frequent visits to emergency departments and hospitalizations [1]. According to the America's Poison Centers (APC) National Poison Data System (NPDS), in 2019, children under the age of three were involved in 31.3% of human exposures, whereas children aged 5 or younger were involved in 42.8% of human exposures [2]. Worldwide, acute poisoning affects 32.6% of children under the age of three and 44.2% of children under the age of five [3]. Acute poisoning is the fourth leading cause of admission to the paediatric emergency department (PED), after drowning, burns, and trauma [4,5].

There are two types of paediatric poisoning: intentional and unintentional [6]. Unintentional paediatric poisoning is mostly caused by

Abbreviations: APC, America's Poison Centers; CNS, Central Nervous System; GI, Gastrointestinal; NHIS, National Health Interview Survey; NPIC, National Poison Information Center; NPDS, National Poison Data System; PED, paediatric emergency department; WHO, World Health Organization.

* Corresponding author at: Department of Pathology Microbiology and Forensic Medicine, School of Medicine, the University of Jordan, Jordan.
E-mail address: khadidi@ju.edu.jo (K.A. ALHadidi).

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children's curiosity and desire to imitate their parents [7]. Leaving children unattended by parents or caregivers may result in paediatric poisoning, which can be fatal [8].

According to the World Health Organization (WHO), poisoning is one of the top five causes of death due to unintentional injury in children [9]. Despite numerous educational and public health campaigns, poisoning remains the most common medical emergency among children [10]. Children are more vulnerable to serious injuries than adults because of their immature psychological and physical systems, lack of hazard awareness, and poor safety awareness and defence against poisons [10].

According to the 2019 APC report, analgesics, household cleaning products, cosmetics and personal care products, antidepressants, and sedatives, hypnotics, or antipsychotics were the top five causes of acute poisoning in children under the age of five [2,11]. Although most paediatric exposure cases are asymptomatic or involve minor symptoms, consuming small amounts of poison can have significant toxic effects [12].

The number of paediatric poisoning cases is increasing, especially in children under the age of five, which shows that current poison prevention measures are insufficient [13,14]. Therefore, monitoring cases of poisoning is a critical step in developing and implementing effective preventive strategies [15].

An epidemiological investigation is required to determine the extent and characteristics of this problem in Jordan. This study was conducted at the Jordan University Hospital NPIC. As the NPIC serves 12 million people [16], investigating the patterns and epidemiology of paediatric poisoning is important in order to control the problem.

The aim of this study was to examine the epidemiological characteristics of paediatric poisoning in children aged 0–5 years, including the age group with the highest rate of poison exposure, sex, exposure route, common causative agents, exposure time, medical outcomes, risk factors, and interventions, to decrease the mortality and severity of child poisoning in Jordan.

2. Methods

This retrospective observational study reviewed data from calls received by the NPIC at Jordan University Hospital regarding poison exposure in children from January 2018 to December 2019. Case records in the poison centre database were based on self-reported calls and included information provided by the public or healthcare providers who reported an actual or potential exposure.

Information regarding each case was documented using standardised forms. The occurrence of paediatric poisoning was described according to the age and sex of the child; call site; exposure site, substance, cause, and route; medical outcome at the time of the call, signs and symptoms, and the date and time of exposure.

Data analysis was performed using SPSS version 25, and data were described using frequencies and percentages. Chi-squared tests were used to determine associations between qualitative variables, and P-values <0.05 were considered statistically significant.

3. Results

3.1. Patient age and sex and call sites

During the study period, a total of 4014 poison exposure cases were recorded at NPIC, of which 3531

(88%) related to children aged 0–5 years old. Most of the 3531 children exposure cases occurred in the 2–3-year-old group (N=1587, 44.9%), followed by the 3–4-year-old group (N=1034, 29.3%), as shown in Table 1. In addition, the 2238 (63.4%) males and 1293 (36.6%) females had ages ranging from 0 to 5 years. More males than females were involved in the 2–3- and 3–4-year-old groups (65.3%–60.2% males vs. 34.7%–39.8% females; P=0.000).

Table 1
Basic characteristics of acute childhood poisoning cases.

Variable	N (%)
Age (y)	
<1	148 (4.2)
1–2	404 (11.4)
2–3	1587 (44.9)
3–4	1034 (29.3)
4–5	358 (10.1)
Sex	
Male	2238 (63.4)
Female	1293 (36.6)
Call site	
Government hospitals	1730 (49.0)
Military hospitals	1065 (30.2)
Private hospitals	467 (13.2)
Others	269 (7.6)

Regarding the call sites, 49.0% came from government hospitals, 30.2% from military hospitals, 13.2% from private hospitals, and 7.6% from other locations such as private doctors or pharmacists, educational hospitals, health centres, and relatives. Furthermore, 50.1% of calls in the 2–3-year-old group came from government hospitals, whereas 30.8% of calls in the 3–4-year-old group came from military hospitals. This relationship was significant (P=0.005).

3.2. Exposure substances and sites

The three most common poisonous substances were medications, pesticides, and household products, as shown in Table 2. Medications (2506 cases) were the most common poison, accounting for 73.2% of cases in the 2–3-year-old group. Approximately 17.6% of the overall cases of paediatric poisoning were attributed to vitamins and supplements, 8.6% to analgesics, 5.2% to antihistamines, and approximately 4.1% to oral contraceptives.

Concerning the exposure site, 3486 children (98.7%) were poisoned at residences; of these cases, 99.1% and 98.7% occurred in the 2–3- and 3–4-year-old groups, respectively. Of the exposure cases that happened outdoors, 14 (0.9%) and 13 (1.3%) cases occurred in the 2–3-and 3–4-year-old groups, respectively, as shown in Table 2. This relationship was statistically significant (P=0.000).

3.3. Exposure causes and routes

Of 3531 cases of childhood poisoning, 3483 (98.6%) were unintentional, 12 (0.3%) were due to medical errors, and 36 (1%) were due to bites and stings. The majority of unintentional cases were in the 2–3-year-old group (N=1576 [99.3%]), most of the medical errors were in the youngest age group (N=6 [4.1%]), and the majority of bites and stings occurred in the 3–4-year-old group (N=10 [1.0%]).

The most common exposure route was oral, which occurred in 3412 (96.6%) cases; 47 (1.3%) cases occurred rectally, and 38 (1.1%) cases occurred dermally. In contrast to 97.6% of poisoning cases occurring orally in the 2–3-year-old group, 3.4% of cases in the 4–5-year-old group were dermal exposures.

3.4. Medical outcomes, signs, and symptoms

The majority of poisoning cases (89.4%) reported no medical effects at the time of the call, whereas minor, moderate, and major medical outcomes and death were reported in 5.1%, 4.6%, 0.8%, and 0.1% of cases, respectively. The poisoning severity according to age groups is shown in Table 2. Deaths occurred in the 2–3-year-old group, while most major medical effects were observed in the 3–4-year-old group (9 of 28 [32.1%] total major effects cases), as shown in Table 2.

Overall, 3165 (89.6%) children had no clinical manifestations. Meanwhile, 128 patients (3.6%) had CNS symptoms, 118 (3.3%) had

Table 2
Distribution of poisoning exposure source, site, cause, and route and medical outcomes according to age groups.

Age (y)	<1 N (%)	1–2 N (%)	2–3 N (%)	3–4 N (%)	4–5 N (%)	Total
Exposure source						
Medications	93 (62.8)	270 (66.8)	1162 (73.2)	743 (71.9)	238 (66.5)	2506 (71.0)
Households	24 (16.2)	66 (16.3)	238 (15.0)	135 (13.1)	53 (14.8)	516 (14.6)
Pesticides	14 (9.5)	29 (7.2)	102 (6.4)	94 (9.1)	32 (8.9)	271 (7.7)
Others*	17 (11.5)	39 (9.7)	85 (5.4)	62 (5.9)	35 (9.8)	238 (6.7)
Exposure site						
Residence	148 (100)	400 (99.0)	1573 (99.1)	1021 (98.7)	344 (96.1)	3486 (98.7)
Outdoor	0 (0.0)	4 (1.0)	14 (0.9)	13 (1.3)	14 (3.9)	45 (1.3)
Exposure cause						
Unintentional	140 (94.6)	398 (98.5)	1576 (99.3)	1020 (98.6)	349 (97.5)	3483 (98.6)
Medical error	6 (4.1)	0 (0.0)	2 (0.1)	4 (0.4)	0 (0.0)	12 (0.3)
Bites and stings	2 (1.4)	6 (1.5)	9 (0.6)	10 (1.0)	9 (2.5)	36 (1.0)
Exposure route						
Oral	127 (85.8)	390 (96.5)	1549 (97.6)	1009 (97.6)	337 (94.1)	3412 (96.6)
Rectal	14 (9.5)	7 (1.7)	16 (1.0)	7 (0.7)	3 (0.8)	47 (1.3)
Dermal	1 (0.7)	5 (1.2)	9 (0.6)	11 (1.1)	12 (3.4)	38 (1.1)
Others**	6 (4)	2 (0.6)	13 (0.8)	7 (0.6)	6 (1.7)	34 (1)
Medical outcomes						
No effect	122 (82.4)	352 (87.1)	1464 (92.2)	927 (89.7)	293 (81.8)	3158 (89.4)
Minor	8 (5.4)	27 (6.7)	60 (3.8)	56 (5.4)	30 (8.4)	181 (5.1)
Moderate	16 (10.8)	21 (5.2)	55 (3.5)	42 (4.1)	28 (7.8)	162 (4.6)
Major	2 (1.4)	4 (1.0)	6 (0.4)	9 (0.9)	7 (2.0)	28 (0.8)
Death***	0 (0.0)	0 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)	2 (0.1)
Signs and symptoms						
Asymptomatic	123 (83.1)	351 (86.9)	1470 (92.6)	927 (89.7)	294 (82.1)	3165 (89.6)
CNS symptoms	9 (6.1)	12 (3.0)	51 (3.2)	35 (3.4)	21 (5.9)	128 (3.6)
GI symptoms	6 (4.1)	17 (4.2)	36 (2.3)	36 (3.5)	23 (6.4)	118 (3.3)
Others****	10 (6.7)	24 (5.9)	30 (0.5)	36 (3.4)	20 (5.6)	120 (3.5)

P-values=0.000
*Hydrocarbons, cosmetics, plants, nicotine-related agents, bites and stings, gases, and heavy metals
**Parenteral, inhalation, and multiple routes
***2-year-old twin boys, aluminium phosphide pesticides
****Cardiovascular, respiratory, kidney, dermal, metabolic, and combined symptoms

gastrointestinal (GI) symptoms, and 120 had other symptoms, including cardiovascular, respiratory, kidney, dermal, metabolic, and combined symptoms. Approximately 92.6% of children in the 2–3-year-old group were asymptomatic.

3.5. Time of exposure and monthly, daily, and seasonal distributions

Most poisoning cases (1915 [54.3%]) occurred between 3:00 p.m. and 9:00 p.m., with peak levels between 6:00 p.m. and 7:00 p.m., as shown in Fig. 1. Furthermore, 28.2% of exposures in the 2–3-year-old group occurred between 6:00 p.m. and 9:00 p.m.

Of the total exposures, 368 (10.4%) occurred in March, and 545 (15.4%) occurred on Tuesday. In addition, 992 (28.1%) of paediatric poisoning cases occurred in fall, 882 (25.0%) in summer, 869 (24.6%) in spring, and 788 (22.3%) in winter.

4. Discussion

Poisoning is one of the most frequent childhood emergencies. The epidemiological characteristics differ between countries; therefore, epidemiological studies are required in each country to determine the preventive measures needed to minimise this health problem. Studies have revealed that children <5 years old are particularly at risk for accidental poisoning [17–19].

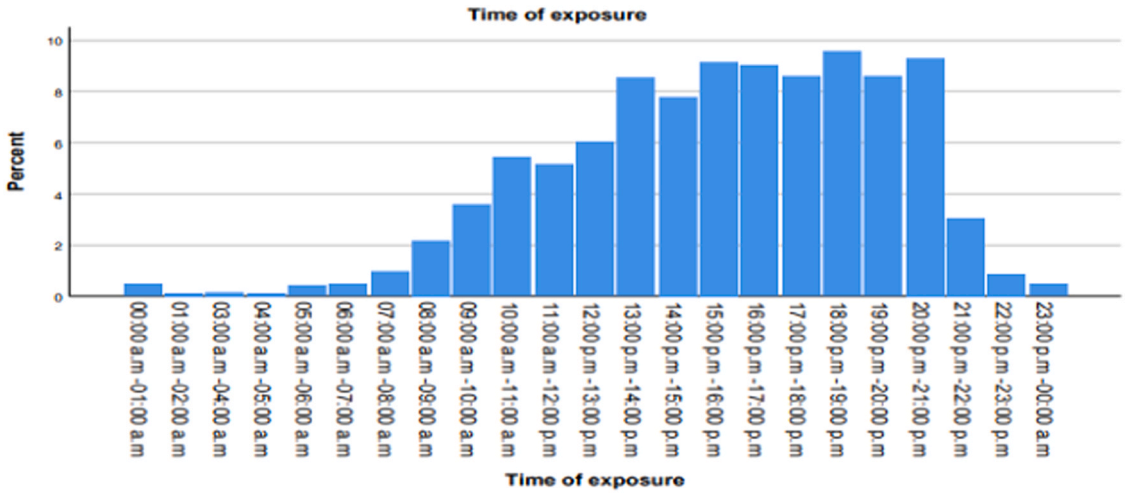

Fig. 1. Distribution of poisoning cases according to the time of exposure.

One of the main findings of this study was the increase in paediatric poisoning cases in Jordan, which accounted for 88% of total poisoning cases referred to the NPIC. In comparison, a previous study in Jordan demonstrated that the frequency in children aged ≤5 years was only 34.9% from 2006 to 2008 [20]. This increase might be due to an increased awareness of healthcare providers and the public regarding NPIC services. In comparison to our findings in Jordan, the 2020 APC annual report revealed that children under the age of six constituted 39% of poison exposures, whereas adults accounted for 47% and teenagers for 8% [21]. The diversity in paediatric poisoning occurrences may arise from several factors, including variances in environmental conditions, cultural norms, healthcare facilities, and access to preventative measures. Additionally, differences in regulatory frameworks, safety protocols, and public awareness initiatives concerning household products and substances might also influence the fluctuating rates of child poisoning incidents. In our study, we noticed a significant rise in paediatric incidents associated with medications, mainly vitamins, supplements, analgesics and antihistamines. This rise in cases can be attributed to the fact that certain medications and supplements are packaged to resemble candy or other familiar items, inadvertently leading children to ingest them. Additionally, inadequate storage or leaving these items within easy reach can facilitate children's access to them. Moreover, the prevalence of medications in households with young children, particularly when working parents entrust their care to grandparents during work hours, likely contributes to this pattern. Conversely, children in developed nations are typically placed in nurseries where access to medications is restricted. In the current study, most poisoning cases occurred in the 2–3-year-old group, followed by those in the 3–4-year-old group, which is congruent with the results of other studies [22,23]. Our findings are consistent with those of a survey from Southwest China that found that the top three age groups for poisoning were early childhood, preschool, and school-age children [10]. Children less than five years of age may have the greatest risk for unintentional paediatric poisoning due to factors such as exploring their surroundings, failing to distinguish between safe and harmful materials, and frequently putting their hands in their mouths. In addition to the child's natural curiosity, the prevalence of poisoning at this age may be caused by the improper home storage of medications, detergents, and chemicals [24].

The majority of poisoning cases in the current study involved males, which is consistent with the findings of studies conducted in Iran, Southwest China, Pakistan, and Taiwan [10,25–27]. Males may have more curiosity, freedom of action, and a higher likelihood of accidents due to cultural factors, such as less family supervision [23].

The majority of calls were from government hospitals, particularly in cases of medication poisoning, followed by those from military and private hospitals. This can be justified by the fact that most of the Jordanian population has government insurance, followed by military insurance.

According to our findings, the most common cause of paediatric poisoning is medications. Similarly, Gheshlaghi et al. identified medications as the most common cause of poisoning in Iran, followed by hydrocarbons [25]. Mendosa et al. [23] in Brazil and Gunay et al. [28] in Turkey also identified medications as the primary cause of poisoning. Agents that cause poisoning are influenced by geographical and economic factors. Poisoning caused by medications, cosmetics, household detergents, and alcohol is most common in developed countries. In contrast, hydrocarbons, pesticides, traditional medicines, and fungi are the most common causes of poisoning in developing countries, where the economy is based on agriculture [25]. This is consistent with a study in Saudi Arabia that showed that drugs were the most common cause of poisoning (70%), followed by chemical materials (29%) [29]. In contrast, the rate is lower in the United States, where drugs are responsible for 48.4% of poisoning cases [30]. Furthermore, an Italian study found that accidental pharmaceutical exposures were a significant poisoning source at all ages [31]. Children in the Middle East are more susceptible to medication poisoning, possibly because they have closer relationships with their grandparents, who take more than one chronic medication. In addition, some medications previously unavailable to young children may have become more accessible. As the prevalence of obesity and metabolic syndrome has increased and affected younger adults, more antihypertensive and antidiabetic medications have been prescribed to parents or siblings in families with small children [32].

Most poisoning cases in the current study occurred at home, consistent with other studies [10,23,33]. This finding can be explained by the fact that children in the 2– 3-year-old group, who comprised the majority of the exposure cases, are often kept at home at this age, where they are exposed to medications found inside the residence.

The NPDS and the National Health Interview Survey (NHIS) have reported that the most common route of poisoning in children is oral [34]. This is consistent with our findings and those of other studies [10,15,25,27,29,31]. This age group appears to have a higher prevalence of oral poisoning because of their propensity to place small foreign objects in their mouths.

The majority of poisoning cases showed no clinical manifestations at the time of the call. More than half of the patients in the 0–5-year-old group were exposed to medications, which may be caused by storing pharmaceutical products where infants can easily access them. In addition, most children in this age group have young parents, and most of their medications are over-the-counter, which may be less toxic than chronic medications [35].

The absence of clinical manifestations at the time of the call may be because the majority of poisoning cases were referred to the centre within 1–3 h of exposure onset [22]. Similarly, the Paediatric Poison Control Center in Italy found that 90% of children whose parents or caregivers called the poison centre were asymptomatic [31]. Haghighat et al. demonstrated that 255 (32.9%) patients showed no clinical manifestations [36]. According to Manzar et al., dyspnoea is the most common clinical manifestation in children [37]. In a study by Srinivasa et al., most children experienced vomiting [38]. Lethargic neurological symptoms were the most common manifestations in a study by Gheshlaghi et al. [25].

In our study, most cases occurred in March, when children in Jordan spend more time indoors and in enclosed spaces. In contrast, the greatest number of admissions for child poisoning in Iran occurred in August [25].

In this study, paediatric poisonings occurred more frequently in the fall than in the summer. Furthermore, 338 (9.6%) of the poisoning cases occurred between 6:00 p.m. and 7:00 p.m. According to Ragab et al., the peak hours for poisoning in Saudi Arabi were between 1:00 p.m. and 11:00 p.m. [39]. In Qatar, poisoning cases usually occurred in the afternoon (29.2%), followed by in the evening (24.3%) [33]. Additionally, Yadav et al. found that most poisoning cases in Eastern Nepal occurred between 2:00 p.m. and 7:00 p.m. [24]. Children may be less supervised by their parents, caregivers, and family members at these times.

5. Conclusion

In conclusion, we found that Jordan has a high percentage of paediatric poisoning cases. Collaborations between the poison centre, the Ministry of Health and other related stakeholders are necessary in order to raise awareness and reduce paediatric poisoning cases through several preventive measures such as stricter enforcement of childproof containers and warning labels, the incorporation of less attractive packaging for pediatric medications and educational initiatives focused on enhancing public awareness about children poisoning, and heightened supervision of children, especially during the afternoon, evening, and holidays.

In the event of paediatric poisoning or suspected paediatric poisoning, we recommend contacting the poison center before taking the child to the hospital, as poison centers have significant impact on reducing hospital use as well as saving healthcare costs. In addition,

once the poison center provides the required accurate poison information to the healthcare team, the child can be treated more effectively and quickly, thereby reducing the hospitalization time and likelihood of death.

Author contributions

Kamal ALHadidi: Conceptualization. Kamal ALHadidi, Suhad Khasawneh: Methodology. Noouralhuda Abbas, Renad Al-Debei and Layan Khraisat: Validation. Enas ALzayadneh, Ihab Alasasfeh and Madeha Faouri: Formal Analysis. Kamal ALHadidi, Enas ALzayadneh, Abdelkader Battah and Madeha Faouri: Investigation. Suhad Khasawneh, Robina Diab and Yaqin Alzagareet: Resources. Kamal ALHadidi, Enas ALzayadneh and Suhad Khasawneh: Data Curation. Kamal ALHadidi, Madeha Faouri: Writing – Original Draft Preparation. Enas ALzayadneh, Suhad Khasawneh: Writing – Review & Editing. Suhad Khasawneh, Madeha Faouri, Ayah Zaqqa and Farah Hadidi: Visualization. Kamal ALHadidi, Enas ALzayadneh, Abdelkader Battah: Supervision. Kamal ALHadidi: Project Administration. All authors have read and agreed to the published version of the manuscript.

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CRediT authorship contribution statement

Farah Hadidi: Visualization. **Kamal Hadidi:** Writing – original draft, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Ayah Zaqqa:** Visualization. **Renad Al-Debei:** Resources. **Noouralhuda Abbas:** Validation. **Yaqin Alzagareet:** Resources. **Robina Diab:** Resources. **Madeha Faouri:** Writing – original draft, Visualization, Investigation, Formal analysis. **Suhad Khasawneh:** Writing – review & editing, Visualization, Resources, Methodology, Data curation. **Abdelkader Battah:** Supervision, Investigation. **Ihab Alasasfeh:** Formal analysis. **Layan Khraisat:** Validation. **Enas ALzayadneh:** Writing – review & editing, Supervision, Investigation, Formal analysis, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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