



ORIGINAL ARTICLE

Root cause qualitative analysis of acute childhood poisonings as a study of sentinel surveillance

Análise qualitativa da causa raiz de intoxicações graves infanto-juvenis como estudo de eventos sentinela

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KEYWORDS

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ABSTRACT

Objective: To analyze the root cause of occurrences of severe intoxication in children and adolescents from the perspective of sentinel events.

Methods: Observational, retrospective, and qualitative study of a series of cases of seven children and young people with a confirmed clinical picture of intoxication by various agents, treated in a stabilization room of emergency care units or intensive care, and notified to toxicological information and assistance center from January to June 2019. The epidemiological surveillance of sentinel events was used based on a review of hospital documents and in-depth interviews with family members. The Root Cause Analysis (RCA) matrix was used to evaluate the cases and the systematic reconstruction of the cases' antecedents.

Results: The age profile of the study population, the pattern of agents and substances involved - poisoning by intentional ingestion in five (71%) cases, indicated critical points and missed opportunities for prevention. The individual and family history analysis indicated as direct causal factors the deviations from norms for preventing poisoning at home or in the family context for all cases. The prevention and health promotion activities in the health services constituted the underlying causes of the occurrences.

Conclusion: The root cause analysis identified a deficiency in public policies, but the interface between education, public security, social assistance, economy, and health policies would be preponderant for preventing childhood and youth poisoning.

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PALAVRAS-CHAVE

Gravidade do paciente
Hospitalização
Políticas públicas de
saúde
Saúde da criança
Saúde do adolescente
Vigilância de evento
sentinela

RESUMO

Objetivo: Analisar a causa raiz de ocorrências de intoxicação grave infanto-juvenil, na perspectiva de eventos sentinela.

Métodos: Estudo observacional, retrospectivo e qualitativo, de série de casos de sete crianças e jovens com quadro clínico confirmado de intoxicação por diversos agentes, atendidos em sala de estabilização de unidades de atenção às urgências ou em terapia intensiva, e notificados a um centro de informação e assistência toxicológica no período de janeiro a junho de 2019. Foi utilizado o referencial da vigilância epidemiológica de eventos sentinela, a partir de revisão de documentos hospitalares e entrevista em profundidade com familiares. Para avaliação dos casos foi utilizada a matriz de *Root Cause Analysis* (RCA), e a reconstrução sistemática de antecedentes dos casos.

Resultados: Perfil etário da população em estudo, o padrão dos agentes e as substâncias envolvidas - intoxicação por ingestão intencional em cinco (71%) casos, indicaram pontos críticos e oportunidades perdidas de prevenção. A análise dos antecedentes individuais e familiares indicou como fatores causais diretos os desvios de normas de prevenção de intoxicações no domicílio ou no contexto familiar para todos os casos. As atividades de prevenção e promoção da saúde nos serviços de saúde constituíram causas subjacentes das ocorrências.

Conclusão: A análise de causa raiz identificou deficiência de políticas públicas, mas a interface entre políticas de educação, segurança pública, assistência social, economia e saúde seria preponderante para a prevenção da intoxicação infanto-juvenil.

INTRODUCTION

Poisonings/intoxications are defined as the set of signs and symptoms caused by the interaction of a toxic agent with the living organism, generating an organic imbalance or pathological state. Toxicological accidents caused by different agents and circumstances are frequent causes of admissions in emergency care units^{1,2}. Data released by the National System of Toxic Pharmacological Information (*Sistema Nacional de Informações Tóxico Farmacológicas - Sinitox*) indicated that 49% (approximately 37 thousand cases) of intoxication in children and adolescents were caused by various agents³.

These situations are public health problems because their impacts on the mortality or morbidity of populations and on organizing and planning health services and actions are recognized from a practical point of view. Poisonings generate demand for care at different levels of complexity of the healthcare system, and there are direct and indirect social costs resulting from these events^{4,5}.

Data from the Ministry of Health indicated 1,437 hospitalizations due to poisoning or accidental intoxication by different agents in the infant and youth population. These hospitalizations cost US\$160,000 for the Unified Health System (*Sistema Único de Saúde - SUS*)⁶. Intoxication/poisoning monitoring is performed on the basis of information from the 37 Information and Toxicological Assistance Centers (*Centros de Informação e Assistência Toxicológica - CIAT*) throughout the country, considered sentinel units, but which do not exist in all Brazilian states⁷. Child and juvenile poisonings comprise most telephone calls to CIAT and are part of the group of compulsorily notifiable diseases, intending to obtain a more comprehensive information about these events^{7,8}.

Sentinel events have been defined since 2008 for the epidemiological surveillance of intoxications/poisonings in human health with case/event definition⁹. The sentinel event surveillance

system monitors critical indicators in the general population or in special groups with the selection of a negative fact with an adverse result and which signals the immediate need to respond to the event's existence. This creates two challenges: understanding how and why the event occurred and preventing the same or similar event from occurring in the future¹⁰.

Thus, there is a study gap to rethink and qualify the organization and functioning of healthcare networks conducted from the care trajectories of families of seriously intoxicated patients, guaranteeing comprehensive care for these users.

The question under study is the root causes of intoxication/poisoning in children and adolescents with a confirmed clinical scenario of severe intoxication by different agents, treated in the stabilization room of emergency or intensive care units. It is assumed that the sentinel event analysis effectively establishes factors involved in the intoxication severity. Thus, this study analyzed the root cause of childhood poisoning with a confirmed clinical scenario of severe poisoning from the perspective of the sentinel event.

METHODS

This is an exploratory, cross-sectional and retrospective qualitative study using the epidemiological investigation of sentinel events and simplified root cause analysis to evaluate cases^{11,12}. The study was conducted in Maringá, Paraná, Brazil, with patients from the emergency care unit of a teaching hospital and reported to a toxicological information and assistance center, called the Poison Control Center (*Centro de Controle de Intoxicações - CCI/HUM*), from January to June 2019.

Children and young people with a confirmed clinical set of intoxication/poisoning by various agents, treated in a stabilization room of emergency care units or intensive care, were defined as a sentinel event. Eligibility criteria were age from zero to 24 years^{13,14}, hospitalization due to intoxication/poisoning in the

pediatric or adult intensive care unit, or stabilization in an emergency room or intensive care units, residents in Maringá, and hospital discharge record as a clinical outcome.

The eligibility criteria for the family member were being in a relationship with the child or young person before and after the intoxication/poisoning, preferably the main caregiver, aged 18 years or older at the time of the interview, and residing in Maringá.

The epidemiological records of Toxicological Occurrence (TO) and the epidemiological records of Toxicological Occurrence of Alcohol Intoxication and/or other Abusive Drugs (TO/AI) were used as data sources, archived in the *CCI/HUM*, and the patient's hospital records. The data collection instrument was the Sentinel Events Investigation Roadmap, semi-structured and composed of four thematic blocks:

- Socioeconomic and demographic data of children and young people;
- Toxicological occurrence/sentinel event;
- Synthesis of the hospital, home, and family investigation of the sentinel event, and;
- Evaluation and case conclusion.

The investigation of the events recommended as a sentinel presupposes document analysis (care and hospital records), interviews with family members, and the case evaluation by a previously constituted Assessment Group¹⁰.

The family interview was performed after the intoxicated person was discharged from the hospital through a home visit by the main author, a *CCI/HUM* on-duty nurse member, and the family members were invited to participate in the study by telephone contact. Data were collected in a single household interview and recorded in digital media by audio with the reconstruction of the individual trajectory of each case - the toxicological occurrence, the contextualization of care and hospitalization, and the access of families to the health service. The average time of the interviews was 20 minutes.

The matrix for evaluating the cases followed the Root Cause Analysis (RCA) model or root cause analysis at the investigation level, with an adaptation proposed by Teixeira and Cassiani¹⁰. RCA is the systematic process carried out after the occurrence of sentinel events, in which the factors that contributed to the event are identified by reconstructing the sequence of events and by constantly questioning the whys.

The analysis stages of sentinel events in the series of cases under study were reconstructed from reading and analyzing the content of documents and interviews, describing the characteristics of intoxication/poisoning and compliance with the principles of comprehensive care in healthcare.

The study was approved by the Research Ethics Committee of the Universidade Estadual de Maringá (CAAE 08937918.6.0000.0104, decision nr. 3,227,049), with the participants signing the Free and Informed Consent Form. The study respected the principles of the Declaration of Helsinki and the Singapore Declaration on research integrity. The anonymity and privacy of the sentinel events and family members were guaranteed, identified by the letter F for family, followed by the

order of the interview/case number, their age, and circumstance of the toxicological event (Ex: F112aAI, F28aAI, F319aTS...).

RESULTS

Thirty-one children and young people diagnosed with intoxication/poisoning by various agents were reported during the study period and treated in a stabilization and resuscitation room or intensive care unit. Following the eligibility and presence of refusal criteria, the analysis unit of this study was a case series of seven sentinel events and seven family members.

Of the 7 cases considered sentinel events, four were female, and the age ranged between 2 and 21 years. The use of drugs as toxic agents prevailed. The circumstances were suicide attempts (SA) among young people aged 12 to 21, who mostly (4 cases) reported mental comorbidities, and two 2-year-old children as an individual accident.

Five families exclusively used the health services linked to the *SUS* for outpatient and hospital care and rated the service as good. Six intoxicated patients were initially treated in the stabilization room, and one of them was admitted directly to the ICU. The maximum length of stay was 20 days (accidental event involving a child).

The reasons for how the child or young person had access to the toxic agent and if the intoxication/poisoning was intentional, why he/she made this decision are described for each case (individual trajectories). Considering information from the interviewed family member and the evaluation group, a synthesis of the proximal and underlying causes was completed (Table 1). Testimonials about the initial care, referrals, and continuity of care are presented below to understand the principles of comprehensive care in healthcare.

Family members reported that the main reason for the event's proximal causes was a single factor that drove it. For the two cases of childhood intoxication, family members considered inadequate storage of the toxic agent, which was referred to as a preventable event or resulting from "carelessness".

In the five cases of SA among young people, the families indicated several isolated risk factors for the event, such as an anxiety crisis after a triggering event with the ex-boyfriend, family/friend/boyfriend discussion, and non-acceptance of gender. There were no reports of underlying factors that could contribute to triggering the suicidal event.

When asked about the preventability of the event, all reported that it could be avoided by educational measures, preventive behavior at home, and continuous psychiatric/psychological medical follow-up.

In the testimonies related to the initial care in the health service and the difficulties, five family members reported that they did not find any difficulty in the initial care.

They said that they had already entered with her, yes, I was not here, right, but they said that they had entered with her. (F119aTS)

We arrived and they had already forwarded it because they said the case was serious. Then, they did the washing. (F315aTS)

It was good, yes, it was immediately, they quickly took it and put it inside. (F402aAI)

No difficulties in service. So much so that I

arrived desperately, and it was they who calmed me down. They said "Mother, this often happens". (F502aAI)

When she entered the UPA, they took very good care of her. She was very well taken care of. Very good service. I have nothing to complain about the hospital. (F612aTS)

Table 1 – Description of each case included in the study. Maringá/PR, Brazil, January - June, 2019.

Case	History	Analysis
F119aTS	Alcoholic beverages and medicines stored at home from family members and psychoactive medication for their own use, prescribed by a psychiatrist for "anxiety crisis", were used but were not used continuously or adequately. Event characterized as intentional after the young woman "saw her ex-boyfriend with another partner". A family member points out the event as an "anxiety crisis/outbreak followed by a migraine" (diagnosed by a neurologist).	Proximal and underlying causes: psychiatric comorbidity, low adherence to and abandonment of psychiatric drug treatment, home stock of psychoactive medication (leftovers), easy access to SA means, use of alcoholic beverages as an adjunct to SA.
F213aTS	Young woman with a medical diagnosis of depression (untreated). He used drugs that his mother and sister used daily, stored at home, and were no longer used (treatment abandonment). Event characterized as intentional after family discussion. The young woman "had been lying for days that she went to school normally", which generated family conflict and the mother's "promise of punishment".	Proximal and underlying causes: psychiatric comorbidity, presence of mental disorder in other family members, home stock of psychoactive medication (leftovers), easy access to SA means, problems arising from adolescence.
F315aTS	The psychoactive medication ingested by the young woman as SA was for her own use. The event was characterized as intentional and occurred after an argument with a friend. The young woman has a history of having committed other previous events for the same reason - "fights with friends".	Proximal and underlying causes: psychiatric comorbidity, poor adherence to psychiatric treatment (depression/anxiety crisis) with medication, easy access to means for SA, previous SA, absence of regular psychological follow-up.
F402Aai	The child was playing unsupervised in the parents' room where the toxic agent (caustic product) was "kept" "behind the wardrobe". Event characterized as unintentional/accidental, which generated gastrointestinal sequelae.	Proximal and underlying causes: poor parental supervision, easy access to the toxic agent, misinformation about the toxicity of the product.
F502aAI	The intoxication/poisoning occurred at a church event attended by the parents in a public square in front of the temple. The child was accompanied by his parents and other children and not knowing about the agent's inadequate storage ("under a bench"), the contents of the bottle were ingested "assuming it was water". Event characterized as unintentional/accidental.	Proximal and underlying causes: misuse and poor storage of the agent (PET bottle), poor parental supervision, lack of knowledge of the high toxic potential of the agent.
F612aTS	The drugs ingested by the young woman were used by other family members and were stored at home as "leftovers", as they were used in other situations. The mother reports that the young woman ingested the drugs as an intentional act secondary to self-mutilation in the upper limbs (cuts). The family does not recognize the girl's gender identity.	Proximal and underlying causes: psychiatric comorbidity, low adherence and abandonment of psychiatric drug treatment, home stock of medicines, easy access to SA means, family difficulty in accepting/dialogue about sexual orientation, self-mutilation as an adjunct/antecedent of SA.
F721aTS	The young man used medication that he and "a friend" used. Event characterized as intentional, as it occurred after an argument with the ex-boyfriend, preceded by the exacerbated use of alcoholic beverages. When drinking alcohol, the young person becomes "more susceptible to arguments and violence".	Proximal and underlying causes: psychiatric comorbidity (untreated?), a habit of using psychoactive drugs without a prescription and drug exchange among young people, easy access to means for SA, harmful use of alcohol, use of alcohol as an adjunct to SA

SA = suicide attempt.

However, two cases reported difficulties in the initial care on the day of the event.

In fact, I told them what had happened and they kept me waiting... they didn't even care. Then, I

saw that she was getting very pale, like her lips... Then, I went into that nurses' room and said: Are you going to let the medicine melt, so you can do something later? Do you not see (observe) the seriousness? Not so fast... they don't have that

urge to look... they don't. Especially, the nurses up front. It's very sad to say this. (F213aTS)

Yes, consultations and service. At the basic health unit (BHU) there was a delay... (F721aTS)

The difficulties reported by family members for the initial care involved the waiting and perception of neglect with the severity of the case. There was a concern that the event would occur again in two families due to the fear of death in the next SA.

I think concern. We are no longer at peace. I can no longer see any medicine out of place, I say: What is this medicine doing here? What happened? (F213aTS)

Oh, I don't know. I think I was more attentive because this was the second time it happened, so... I always pay attention to some situations, we always try to talk more. (F721aTS)

Regarding the two events with accidental circumstances, a family member reported a change in the storage of toxic agents, which were left in a place out of reach of the child.

Yes, I still use it (kerosene), but I don't leave it where I left it. It was more like that, because other things, like bleach, the things I use to wash clothes, I leave them in the machine, and he doesn't have access. (F402aAl)

The difficulty in accessing the referenced service and the report of absence of forwarding was evidenced on the path encouraged for treatment continuity, such as referral to primary care/basic health care and psychosocial care, given that these are moderate or clinically severe events.

I expected more on the psychological side. I have tried several times to do psychological care at the BHU and at the University. There is a very long waiting list and I only managed to find it at... (in a service) because I know the teacher who coordinates it. I talked to her, and she fit me in. We end up giving up, why don't you call. (F721aTS)

DISCUSSION

Child and adolescent morbidity and mortality are one of the health and social development indicators, as they are related to the socioeconomic and health conditions of the population and the educational level of the parents¹⁵. Child and juvenile intoxications/poisonings make up most of these events in all world countries, with shared characteristics of gender, age, and circumstance in most countries^{1,2,16}.

Behavioral, social, and cultural aspects may

justify the higher values in accidents involving boys aged up to five years since they tend to be less supervised in their outdoor activities and take more risks in their recreational activities^{3,15,16}. Additionally, cases of poisoning by chemical substances in this age group usually happen accidentally, with a low mortality pattern¹⁶.

It is estimated that these events are responsible for more than five million diseases annually² and the occurrence of hospitalizations of children and adolescents verified in epidemiological surveys corroborates the profile of this series of cases¹⁹.

In the last decades, SA, meaning acts performed by people aiming at death but which are not achieved for different reasons, have increased among the young population, mainly aged between 14 and 24 years, representing the group of greater vulnerability to suicidal thoughts behavior^{20,21}. This agrees with this study, demonstrating that SA occurred in 12 to 21 years.

Although they represent a non-fatal behavior, SA are harmful due to the potential to repeat the act and increase the risk of suicidal success with each new attempt. There are several risk factors for suicidal behavior, and the most frequently mentioned for all age groups are the existence of a mental disorder and a previous suicide attempt²².

In addition to the personal characteristics of the life cycle, the incidence of childhood poisoning/intoxication can be justified by factors associated with low social (family and society) and State protection, recognized in the literature and which contribute to the poisoning pattern in Brazil. Concerning society, there are medicalization and self-medication, inadequate and easily accessible storage of products containing potentially toxic substances (domestic use, pesticides, veterinary use, medicines), negligence, and lack of information from parents and guardians about the intrinsic toxicity of these products²²⁻²⁴.

Moreover, the difficult access to health services and inadequate professional training for comprehensive and effective care, insufficient control of prescriptions and marketing of medicines, the permission of indiscriminate advertising of medicines, licit drugs of abuse, other toxic products in the different media, and the absence of legislation within the scope of health surveillance are observed regarding the role of the State^{22,25}.

The extended hospital stay implies the complexity and clinical severity of intoxication/poisoning cases. The clinical severity of intoxication was established based on the care level used for treating the intoxicated/poisoned person, understanding the severity of the occurrence as implied by the complexity of the care. Hospitalization in intensive care and assistance in stabilization rooms using technology and human resources to care for critically ill patients is essential to support the life of individuals with intoxication classified as severe with imminent risk of death and can be used alone as an indicator of the severity of cases^{19,26}.

The summary of the antecedents highlights deviations from the norms of prevention in the home or family context as proximal causes, such as inadequate storage of chemical products, availability in homes, and ease of access. Furthermore, household stock of

psychoactive drugs should be considered a facilitator of intentional use by young people.

However, based on the concept of the sentinel event and the definition of the sentinel event proposed for this study, there were occurrences related to possible insufficiency in other levels of health services in underlying causes that generated failures in preventing severe or moderate toxicological occurrence. Comprehensiveness presents itself as a multidisciplinary intervention in thinking along the lines of comprehensive care for the prevention and treatment of intoxication/poisoning, with professionals working in a referral and counter-referral system, looking beyond medical care with the intoxication of the individual treated at the hospital, and questioning the contextual meaning of what happened beyond the biological care²⁷.

Intersectoral actions of educational interventions to disseminate educational campaigns on preventing toxic accidents and self-poisoning, and strategies for training and qualifying professionals for resolute care are necessary, and at the same time offering professional training and assistance, as well as implementing specialized care service in *CIAT*. However, counseling parents and children in isolation has not effectively prevented accidents^{28,29}.

The risk of suicide increases with the number of attempts and is associated with shorter time intervals between these attempts, the single most important predictive factor for a suicidal event³⁰. The operationalization of the sentinel event pointed to flaws in social and family dynamics, but inadequate and deficient public policies contribute to its occurrence and continuity. Regarding the root causes, the medicalization of society in a context of an epidemic of mental disorders and the presence of highly toxic products in households were recognized. Substituting agents with greater intoxicating potential and the immediate availability of care and specialized information are strategies recommended by the World Health Organization to prevent childhood poisoning and

reduce associated injuries³¹.

It was possible to identify weaknesses in the processes that favor the occurrence of toxicological accidents and that care remains fragmented and focused on the "aggravation" of the disease. The benefits arising from the research tool outweigh its possible weaknesses and limitations due to the critical thinking developed and the application of the system on each incident that occurred.

Study limitations include the high exclusion rate from the eligible sample due to the lack of updated data or incomplete data, which made it challenging to locate the participants, and because it is a local scenario with a low capacity to infer results.

CONCLUSION

This study assumes that certain occurrences attended in the emergency care network, chosen based on the concept of a sentinel event, may be related to failures in primary care and can be used to monitor care in local management, specifically for preventing poisoning/intoxication accidents.

It is a new system that contributes to expanding knowledge about the impact of intoxications/poisoning on the Brazilian population. The epidemiological investigation presented here goes beyond traditional standards due to its less pragmatic character and more qualitative approach.

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