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Child Nonintentional Injury Prevention

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1. Introduction

Childhood nonintentional injuries continue to be an important public health problem the world over, involving individuals of different ages and socioeconomic conditions. If, on the one hand, medicine advances in the early detection of diseases, specialized treatments and advanced rehabilitation techniques, on the other, it can be seen that injury continues to be an important and relatively little studied cause of morbidity, permanent disability (neurological deficits, amputations, scars, and emotional damage) and death, especially among children [1, 2].

Epidemiological information about childhood injury is still partial and incomplete since this is a multidisciplinary, undefined and very extensive work field that requires the action of qualified and experienced professionals in order to understand the multiple aspects associated with the occurrence of this problem. In addition to obtaining statistical information about mortality and more serious injury, it is necessary to explore the large number of events that remain hidden in the community, with no records in medical care services but very important for the various strategies to be directed at the promotion of health and at the prevention of harm to children's health [30, 39].

2. Epidemiology

More than 2000 children die every day worldwide due to unintentional injury, and many other thousands suffer sequelae and definitive disabilities. According to the World Health Organi-

zation, about 10% of the world population is affected by some type of sequelae due to injury, with most of these individuals still being of full reproductive age [14, 27].

In the US, more than 12 million children receive medical care every year due to injury, with more than 132,000 hospital admissions. The annual economic burden is estimated at more than \$ 80 billion in medical costs, lost work productivity, lost wages and other expenses [18, 32].

3. Definition

Injury is defined as “an amount of energy (thermal, mechanical, chemical, etc) that exceeds the tolerance capability of the human body and results in damage or lack of vital elements such as oxygen”. It is an event independent of the human will provoked by an external force that acts rapidly on an individual and manifests as body and/or mental damage [3, 4].

As is the case for all other diseases, the study of unintentional injury can use the epidemiological model characterized by: a) agent (energy), b) host (child), and c) environment. Thus, injury results from an unfavorable interaction between an etiological agent and a susceptible host, occurring in a determined environment and at a defined moment. On this basis, injuries are not distributed at random among populations, where the interaction between these factors determines the probability and the nature of the event, also considering that the facts accompanying the event are as important as the injury itself [5, 6].

4. The child as a host

The predisposition of children to unintentional injury is related to a large number of socioeconomic, educational and cultural factors. Low income, low educational level of the family, dysfunctionality, difficult access to health services, the use of alcohol and drugs, inadequate supervision, the lack of leisure areas, and unbecoming environments are elements known to be directly related to childhood injury [15, 21, 25].

Regarding children, we should consider their own characteristics which make them more prone to unintentional injury. Thus, within the context of their different developmental stages, we should emphasize physical and emotional immaturity, their inability to anticipate and avoid dangerous situations, their imperfect control of impulses and emotion, great curiosity, inexperience, motivation to perform tasks, tendency to imitate and repeat behaviors, lack of preoccupation about their body, impatience, and limited motor coordination. Also their anatomical peculiarities should be considered, such as skull-body disproportion, the small dimensions of their upper airways, hand-to-mouth personality development, relative weak musculature, large subarachnoid space, cranial bones not fused at the level of the cranial sutures, immature brain, and thin skull. In many situations, children usually must adapt to the world of adults, which is hostile and unknown to them, often having to acquire knowledge by the trial and error method [38].

Epidemiological studies can identify characteristics that help with the construction of the profile of children who are more injury prone. This knowledge is fundamental for the implantation of preventive and educational actions. The main characteristics of this profile are listed below [28, 31].

1. male sex: boys carry out more extroverted and vigorous activities less controlled by adults, with more social requirements and therefore a greater exposure to risks.
2. age of more than one year: the child is able to move by itself, crawling or walking and running, thus expanding its social space and escaping the surveillance of adults.
3. older parents: temporal distance between generations is a factor that complicates the care devoted to the safety and education of the children.
4. large family: when other children share the same physical space, dividing the attention of adults, or when younger children are cared for by other children.
5. physical and/or mental fatigue: children with many social requirements may show physical or emotional stress that makes them more prone to injury due to lack of attention
6. organic or emotional diseases: any factors that may change the dynamic equilibrium of a child are directly related to the occurrence of unintentional injuries at all ages.

5. Age range and types of injuries

Children start from a state of complete physical and mental immaturity and progressively acquire knowledge and skills that permit them to incorporate attitudes of protection and comfort. Thus, and in a more didactic manner, it is possible to point out their main characteristics according to the phase of neuropsychomotor development and the unintentional injuries more commonly occurring in this age range [7, 8, 13, 17, 22].

- a. Newborn to 6 months: the infant is completely dependent on adults for its survival (feeding, being kept warm, hygiene, transportation, safety etc.), is immature and unable to control impulses and emotions, thus being prone to some types of injuries such as intoxication with medications, drowning in the bath water, asphyxia with milk, talcum or small objects, scalding with the bath water and feeding bottle, cigarette burns or burns due to prolonged exposure to the sun, traumas in general, especially falling off the carriage, the lap of an adult and during the bath.
- b. 7 months to 2 years: the child is acquiring greater voluntary ability to move (rolling in bed, sitting, crawling, walking) and starts the oral phase of personality development, feeling more stimulated by the environment. Starting from this age, any type of injury may occur, the most common being falls, burns, intoxications, suffocation, ingestion of foreign bodies, being run over, aggression by venomous animals, animal bites, drowning, and electric shock.

- c. up to 2 years of age, the neuromotor development of the child becomes more specialized, the child expands its social environment and is less dependent on adults, who also, naturally, start reducing their surveillance of the child. They have great curiosity, a low ability to anticipate risks, they are unaware of danger and they imitate various behaviors, thus being exposed to a large number of risks such as being run over, drowning, falls, burns, intoxications, electrical shocks, animal bites, and aggression by venomous animals. After five years of age, children are more developed, with a greater ability to learn and to protect themselves, but they still suffer external influences and are little supervised by adults, continuing to be exposed to the same risks.

Practically half the unintentional injuries in the whole world occur at home, i.e., in the place where children spend most of their time. In the domestic environment, the sites of higher risk are: a) the kitchen, which contains sharp or pointed objects, a stove, gas, appliances and cleaning products; b) the backyard/garden, where leisure activities and sports practice occur and where pets are raised, and/or which serve as work areas for the family; c) the room where the family gathers for the meals, for evening leisure and for receiving visits. Thus, the domestic environment, either because of its poverty or because of its increasing sophistication due to technological development, becomes highly dangerous for children, since the progress of comfort for human beings is not always accompanied by the necessary safety measures. Outside the home, the street and the school greatly contribute to the high rates of injuries predominating among children older than five years.

6. Characteristics of unintentional injuries

Seasonality is also related to the occurrence of injuries, with a higher incidence of these events on weekends or during school vacation (especially the European and North American summer), when the warmer and more agreeable climate stimulates physical and leisure activities, competitions, trips etc. During the winter, when people spend more time at home and in closed environments, other types of unintentional injuries can also occur, especially intoxication due to alcoholic drinks [12, 29].

7. Prevention

Unintentional injuries are an endemic problem that requires permanent actions for its prevention and/or control. The predisposition of children can only be neutralized by the adults responsible for their education and safety. In this respect, the identification of risk factors is necessary in order to elaborate Prevention and Control Programs, which should contemplate strategies at the primary level such as prevention of new injuries; strategies at the secondary level such as reduction of injury severity, and strategies at the tertiary level such as reduction of the frequency and severity of the sequelae [33-37].

According to the classical Haddon Injury Control Model, injuries are due to energy (thermal, chemical, kinetic, radiation and electric) that is transferred to the child by a determined vector.

Thus, measures aiming at avoiding or reducing the effects of this energy transfer should be implemented in order to protect the individuals [19, 20].

The main measures that can be adopted are:

- a. avoiding the release of energy
- b. distancing the individual from the source of energy
- c. reducing the quantity of released energy
- d. using barriers between energy and the body
- e. strengthening the structure that receives energy
- f. modifying the surface of contact
- g. modifying the space distribution of energy

Thus, efforts should be directed at expanded health education actions according to each social reality, involving health services appropriate for care that will reduce sequelae, family and social rehabilitation and reintegration, the training of professionals of all categories that deal with children, and appropriate legislation directed at the prevention of unintentional injuries and at the protection of vulnerable persons. Communication among citizen, public health researchers and legislators are necessary to promote more effective policymaking. Anticipatory guidance in pediatric practice, to children, parents and society as a whole, expanding the educational level can improve general safety behaviors.

It should be pointed out that prevention involves education, instruction and advocating for changes to improve child safety, such as changes in the environment and in various products, and the elaboration and application of laws aiming at the protection of children. Physicians and all other health professionals who are aware of the peculiarities of children, of the family environment and of habits and attitudes should practice preventive medicine. All they need for this purpose is to incorporate the basic principles of home safety and injury prevention into their habitual conduct, transmitting them in the form of guidance and counseling during medical visits, home visits or group meetings of parents and caregivers. It is possible to establish differentiated guidelines for each age range based on the stage of neuropsychomotor development and on the awareness of the social reality in which the child is inserted, always using common sense and logic as the framework for the establishment of a safe and healthy environment for the child.

With the effort and participation of the entire community, especially of its leaders and of its more differentiated segments, decisively acting in order to be able to modify environments and/or behaviors, it will be possible to correct the more critical situations and to mitigate the damage caused by unintentional injuries to children's health [9-11,16,23-26].

Anticipatory Guidance for Injury Prevention

Always supervise the child's activities

Newborn to 6 months

- breastfeed the child in a sitting position
- child should sleep supine
- avoid using pillows
- remove loose bedding clothes, quilts, stuffed toys and soft objects from cradle
- check temperature of bath water
- avoid prolonged sun exposure
- do not use talc
- do not use drugs without medical advice
- avoid toys with sharp objects, sharp edges, loose paint or disassemble it into small pieces
- bed should have protective grilles
- do not handle hot liquids or food with child in lap
- do not leave the baby in the care of another child

7 months to 2 years

- do not leave medicines, herbs or small objects within reach of children; store in a safe place
- use of protective electrical outlets
- do not leave child unattended while bathing near the pool, river, beach, pond, or large containers with water
- do not leave your child unattended at sites that are uneven or near windows
- use gates for stairways and pool fencing
- use protective grilles on windows, pools, stairs and elevated parts of the house
- hinder children's access to home appliances
- keep combustible chemicals, cleaning materials and liquids out of the reach of children
- keep sheets and blankets always stuck to the mattress
- avoid contact of the child with candy, food into small pieces and fruit pits
- beware of ornamental plants,
- keep plastic packaging, ribbons and cords out of the reach of children
- avoid contact with animals, whether domestic, which should always be healthy and vaccinated,
- use appropriate equipment (child restraints) for transporting children in vehicles
- do not use infant walkers

Up to 2 years

- beware of high places, furniture that can be scaled and unstable objects of decoration
- do not leave your child alone in the kitchen or service area of the house
- keep sharp objects, knives and tools out of the reach of children
- do not leave children unattended in streets, parks, places with a lot of movement of people and vehicles
- store medicines in a safe place
- do not use food packaging to keep harmful products to health
- always keep clean the yards, gardens and grounds adjacent to the house
- keep tubs, tanks and buckets empty after use
- avoid handling of fireworks
- cycling with helmet, elbow and knees pads, and appropriate locations
- installing energy-absorbing surfacing material in playgrounds
- teach basic rules of conduct in traffic, because the child is passing pedestrian and vehicle

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