GUIDE 50

Safety aspects — Guidelines for child safety

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Contents

Page

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

Guides are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft Guides adopted by the responsible Committee or Group are circulated to national bodies for voting. Publication as a Guide requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this Guide may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC Guide 50 was prepared by the Joint ISO/IEC Technical Advisory Group (JTAG) for Child Safety.

It should be used in conjunction with ISO/IEC Guide 51, *Safety aspects — Guidelines for their inclusion in standards*.

This second edition cancels and replaces the first edition (ISO/IEC Guide 50:1987), which has been technically revised.

Annexes A and B of this Guide are for information only.

0 Introduction

0.1 Relevance of child safety

Child safety should be a major concern for society because childhood and adolescent injuries are a major cause of death and disability in many countries. Children are born into an adult world, without experience or appreciation of risk but with a natural desire to explore. Consequently, the potential for injury is particularly great during childhood. Since supervision to the degree that always prevents or controls potentially harmful interactions is neither possible nor practical; additional injury prevention strategies are necessary.

Intervention strategies aimed at protecting children must recognize that children are not little adults. Children's susceptibility to injury and the nature of their injuries differ from those of adults. Such intervention strategies must also recognize the fundamental concept that children do not misuse products or surroundings. Rather, children interact with them in ways that reflect normal child behaviour, which will vary according to the child's age and level of development. Therefore, intervention strategies intended to protect children might differ from those intended to protect adults.

The challenge is to develop products, structures, installations and services (collectively referred to as *products*) in a way in which the potential for injury to children may be minimized. Preventing injuries is everyone's responsibility. Prevention of injuries can be addressed through design and technology, legislation and education.

0.2 Role of standards

Standards can play a key role in injury prevention and control because they have the unique potential

— to draw on technical expertise for design and manufacture,

— to implement solutions through legislation, and

— to educate through provisions for instructions, warnings, illustrations, symbols, etc.

If standards are to fulfil their role in childhood injury prevention and control, standards-writers must consider how children might interact with the products their standards are addressing, regardless of whether or not those products are aimed specifically at children.

NOTE The word “standard” in this Guide is intended to include other ISO/IEC publications, for example Technical Specifications and Guides.

0.3 Structure of the Guide

This Guide consists of three main parts and two annexes as follows.

a) General approach to child safety, including the principles for a systematic way to address hazards (4.1 and 4.2).

b) Specific developmental characteristics of children that place them at particular risk of injury (4.3).

c) Hazards to which children might be exposed during their use of, or interaction with, a product, along with specific suggestions for addressing those hazards (clause 5). These hazards are also listed in ISO/IEC Guide 51 but, here, the focus is on the specific risk to children associated with those hazards.

Annex A provides an overview of hazards, potential injuries and approaches to solutions. However, it is essential that it be read in conjunction with the main body of this Guide as it only gives a few examples of solutions.

Annex B is intended as a checklist for standards-makers to assess their taking into account child safety.

Safety aspects — Guidelines for child safety

1 Scope

This Guide provides a framework for addressing potential sources of unintentional physical harm (hazards) to children from products, processes or services that they use or with which they may come into contact, even if they are not specifically intended for children. The framework aims at minimizing risk of injury to children.

It is primarily intended for those involved in the preparation and revision of standards. However, it has important information that can be useful to, amongst others, designers, architects, manufacturers, service providers, communicators and policy makers.

For children with special needs, additional requirements may be appropriate. This Guide does not claim to address those additional requirements in full. ISO/IEC Guide 71 addresses the needs of persons with disabilities.

A product may include goods, structures, buildings, installations or a combination of these.

No specific guidance is given in this Guide for the prevention or reduction of psychological or moral harm or of intentional injuries.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this Guide. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreement based on this Guide are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC Guide 51:1999, *Safety aspects — Guidelines for their inclusion in standards*

3 Terms and definitions

For the purposes of this Guide, the following terms and definitions apply.

3.1
risk
combination of the probability of occurrence of harm and the severity of that harm

[ISO/IEC Guide 51:1999, definition 3.2]

3.2
harm
physical injury or damage to the health of people or damage to property or the environment

[ISO/IEC Guide 51:1999, definition 3.3]

NOTE In this Guide the word “injury” encompasses damage to health.

3.3
hazard
potential source of harm

[ISO/IEC Guide 51:1999, definition 3.5]

3.4
child
person aged from birth to 14 years

4 General approach to child safety

4.1 General

The safety concepts that distinguish child safety from safety in general are explained in this clause. These concepts are additional to the contents of ISO/IEC Guide 51.

4.2 Risk assessment

Risk assessment is an important step in any injury prevention strategy. The general approach is outlined in ISO/IEC Guide 51. The main questions to ask in a risk assessment process are the following.

a) What can happen?

b) How probable is it?

c) How severe is the resulting injury?

When addressing child safety, the answers to these questions must take into account the following special factors for children:

a) their likelihood of being injured;

b) their interactions with persons and products;

c) their development and behaviour;

d) their lack of knowledge and experience;

e) social/environmental factors.

4.3 Preventing and reducing injury

Injury or disease can result from the transfer of energy (mechanical, thermal, electrical), or exposure to agents (biological, radiation) greater than the body's capacity to withstand. They can be prevented or reduced by intervening in the chain of events leading to or following their occurrence.

Strategies can address the following:

— preventing the harmful event from occurring or reducing exposure to hazard *(primary prevention)*;

— reducing the severity of injuries *(secondary prevention)*;

— reducing the long-term effects of the injury through rescue, treatment or rehabilitation *(tertiary prevention)*.

In addition, strategies can be passive or active. Passive strategies work without the individual having to take any action to be protected. Active strategies require the individual to take some action. Designing safe products generally results in primary prevention; incorporating passive protective strategies generally ensures a greater likelihood of success.

Various sources can be used to identify the potential for injury associated with a product. These include, but are not limited to

— injury statistics,

— detailed information available from injury surveillance systems,

— research studies,

— investigations of case reports, and

— complaint data.

CAUTION — The absence of reported injury does not necessarily mean that there is no hazard.

As injuries to children are closely related to their developmental stage and their exposure to hazards at various ages, it is important to sort child injury data by age group to identify the patterns that emerge. For example, in some countries, burns from oven doors, scalds, poisoning by medicines and household chemicals and drowning have peak rates in children under 5 years of age; injuries associated with falls from playground equipment peak at 5 to 9 years; and injuries associated with falls and impacts related to sports peak at 10 to 14 years.

The identification of appropriate countermeasures results from processes of research and evaluation, particularly based on the methods of epidemiology, engineering and biomechanics as well as by the feedback cycle of gradual improvements to design. When choosing preventive measures, it should be recognized that tolerable levels of safety/risk for adults might not be sufficient to protect children. When introducing measures designed to protect adults it is essential to consider any potential effects that might increase risks to children (e.g. passenger side air bags in cars).

4.4 Child development and behaviour

4.4.1 General

Children are not small adults. Inherent characteristics of children, including their stage of development, together with their exposure to hazards, put them at risk of injury in ways different from adults. Developmental stage broadly encompasses children's size, shape, physiology, physical and cognitive ability, emotional development and behaviour. These characteristics change quickly as children develop. Consequently, parents and carers often over- or under-estimate children's abilities at different stages of development, thus resulting in exposure to hazards. This situation is compounded by the fact that much of the environment that surrounds children is designed for adults.

All the childhood characteristics described below need to be considered in determining potential hazards associated with products. It should be kept in mind that these characteristics may act in combination, increasing the child's risk of injury. For example,

— exploratory behaviour might lead a child to climb a ladder,

— limited cognitive skills might prevent the child from recognizing that the ladder might be too high or unstable, and

— limited motor control might result in the child losing grip and falling.

The way children use and interact with these products must be considered as normal childhood behaviour. With regard to children, the term “misuse” is misleading in this respect, and may lead to inappropriate decision-making regarding hazards for children. Survey evidence shows that children regularly use products that were not designed

for them, such as microwave ovens. When a child interacts with a product, it is difficult to make a distinction between play, active learning or intended use. For safety reasons it might not be constructive to attempt to distinguish between such interactions.

While safety considerations should provide an appropriate balance between the risk of injury and freedom for children to explore a stimulating environment and to learn, the goal is to reduce the risk of injury by design until such time as the child has developed an ability to assess risk and take appropriate action.

4.4.2 Children's body size and anthropometric data

Certain characteristics of children's body size and weight distribution make them vulnerable to injury. Their overall mass is smaller, thereby reducing their capacity to absorb injury-causing energy. The following are examples where body size and weight distribution, as compared to adults, are factors in injury.

a) In the case of thermal injuries, a relatively small area of contact can affect a large proportion of their body surface. The large surface area in relation to the small body mass can result in a greater proportion of body fluids being lost from the burnt area.

b) Young children have a large head compared with their body size. Their high centre of gravity increases the likelihood of falls, for example from furniture or structures on which children may be seated, climbing or standing. Children often fall directly onto the head without breaking their fall with their arms.

c) Another effect on the high centre of gravity is that it also increases the risk of falling into pools, buckets, toilets, etc., into which children are bending or reaching, thereby increasing their risk of drowning.

d) The relatively large size of the head means that it requires a much larger space to pass through than the rest of the body. Entrapment can occur when the body passes, feet first, through a gap through which the head cannot pass.

e) Children might be able to insert their fingers, hands or other parts of their body into small openings to access rotating parts, electrical wiring or other hazards.

f) The relatively large mass of the head increases the likelihood and severity of a whiplash injury.

Children’s size in relation to their surroundings makes it necessary to examine their anthropometry, including overall heights as well as body part lengths, widths and circumferences. Anthropometric data should be consulted in order to establish the normal distribution and safety margins.

4.4.3 Motor development

Motor development refers to the maturation process of gross and fine movements. The process includes changes from primary involuntary reflex actions to deliberate, goal-directed actions. Milestone achievements in the process include acquiring the strength and skill to support the head, crouch, sit up, rollover, crawl, stand, climb, rock, walk, run, and the ability to manipulate objects with hands and fingers. Until balance, control and strength have sufficiently developed, children are at risk of falling and getting into unsafe positions from which they cannot escape. The following are examples.

a) When lying, infants can move to the edge of a surface and roll off, but be unable to lift themselves back onto the surface. As a result, they can become wedged in or between products and suffer positioned or compression asphyxia.

b) Standing infants and toddlers can become entangled in cords, ribbons, or window dressings within their reach. When they sit or slump, the cords can tighten around the neck, resulting in strangulation.

c) Climbing infants can get clothing caught in furniture items or protrusions. If they cannot extricate themselves, they can hang.

d) Children fall from heights because they lose their balance or grip.

Understanding what motor skills a child can/cannot accomplish can be an important tool in the design of safer products and also in the design of interventions. For example, access to lift (elevator) platforms can be designed to be out of reach for crawlers, and child-resistance measures can take advantage of the lack of well-developed motor skill.

4.4.4 Physiological development

In addition to body size and motor functions, there are many other physiological functions that develop in children. These include sensory functions, biomechanical properties, reaction time, metabolism and organ development. The following are examples where incomplete physiological development can be a factor in injuries:

— children are vulnerable to poisoning, since medications, chemicals and plants can be toxic to children in smaller amounts than to adults;

— the nature of their skin makes children more vulnerable to thermal injury;

— children's bones are not fully developed, resulting in different responses to mechanical forces.

4.4.5 Cognitive development

Children's stages of cognitive development determine their ability (inability) to assess risk and make informed decisions. Cognitive functions that are not fully developed result in the lack of ability of young children to assess the situation in which they find themselves and save themselves from hazards. In the first year or two of life children appear to have no sense of danger. Thus, whereas normally allowance can be made for hazards that are obvious to the user and are necessary for the function of the product, these hazards might not be so obvious for children. At some stage in early childhood, prior experience and parental/carer teaching begin to influence the child's behaviour. Coping with limited risks is therefore a natural part of children's learning.

Certain behavioural characteristics associated with early childhood also render children at risk of injury. These include the following:

— putting things into their mouths (mouthing), particularly in the first three years of life, exposing them to ingestion and aspiration risks;

— putting things in other body openings, exposing them to impaction and laceration risks;

— natural inquisitiveness and exploring behaviour;

— a relatively small head width, combined with a relatively large head height and length enable children to enter spaces head-first in one orientation, but they are unable to understand how to position their head to exit the space;

— starting to develop individuality at around 2 years, resulting in saying “no” and refusing help, for example when eating;

— assertion of their independence at about 3 to 4 years;

— attraction to taste, smell, design, and colours (e.g. medications).

Since young children explore by mouth, products that are for use by, or likely to be used around, children should not have small easily removable parts. Objects not meant to be put into the mouth, such as erasers or small toys, should not be made to resemble food.

Child behaviour often mimics that of adults and older children. This behaviour can become dangerous when children do not understand the implications of their actions. For example, they may administer medications to their younger siblings, operate locking mechanisms and switch on appliances.

Children cannot necessarily be expected to recognize the difference between a real object and an imitation or model, either of which might be harmful. The use of images for products, which may be associated with toys, such as cartoon characters for hairdryers, lanterns and cigarette lighters, can be misleading and potentially injurious for children.

Reading and communication skills take years to acquire. Warnings and information, including the use of simple methods such as pictograms (symbols), might have no meaning to children.

4.5 Physical and social environment

4.5.1 General

In addition to taking into account child development, it is necessary to consider both the physical and social environment in which a child might use or come into contact with a product. Product safety might be affected by the natural and built environments, climate, language, customs, attitudes and beliefs, knowledge and users' experience.

4.5.2 Physical environment

Specific physical environmental factors related to intended and unintended location of use (such as indoor/outdoor, private/public space, supervised/unsupervised area) and factors such as the effects of weather and terrain must be considered. Interaction with other activities and people, potential for unsupervised activity and the potential for a child to ever be exposed to a particular setting are also relevant. Settings not intended for children, but to which they become exposed or have access (such as the parental workplace and the traffic system), pose greater challenges. Where hazards cannot be controlled, barriers to exposure must be employed.

4.5.3 Social environment

Psychological considerations that might affect intended versus unintended use might also relate to the global geographic location in which the product can potentially be used. The opportunity for global trade requires careful attention to the subtle translations of language and the prevailing customs and attitudes based on cultural/ethnic differences, so that these interpretations of product use do not inadvertently become hazards.

The relationship between parents/carers and children can be expected to vary with geographic, cultural/ethnic and socio-economic differences. Cultural variations of discipline, supervision and safety awareness should be recognized. Although supervision is an important aspect of child safety, it can never replace inherent safety, even when the child is within visual or auditory range of the parent or carer.

As children approach adolescence, peer pressure and risk-taking behaviour can affect the use or consumption of the product. Recreational activities might be associated with higher risk behaviour relating to presumed increased protection from "safety" equipment, aggressive behaviour inherent in the competitive nature of sports, and the greater risk of injury related to attention-seeking behaviour.

5 Hazards relevant for children

5.1 General

In view of the facts presented in the preceding clause, the risks associated with products can be high for children. Product-related hazards and their potential to injure children are discussed below. Examples based on reported injury patterns are provided to help users of this Guide to understand the hazards. It is important to recognize that individual hazards can act in combination to produce injuries that might be different from, or more severe, than those associated with the individual hazards separately.

It is equally important to realize that new hazards can emerge and enter the environment of children due to developing technology and changes in lifestyles, such as working at home (teleworking), and sophisticated medical care at home (e.g. use of gas cylinders and monitoring devices).