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BSI Standards Publication

Injection systems for self-administration by paediatric patients — Requirements and guidelines for design

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Injection systems for self-administration by paediatric patients — Requirements and guidelines for design

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 84, *Devices for administration of medicinal products and catheters*.

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Introduction

An increasing number of therapies for paediatric use rely upon a drug delivery system for administration. However, many existing drug delivery systems in widespread use incorporate design features that might not conform with current thinking on human factors/usability engineering principles for use by the paediatric population or include some significant differences from those applicable to the average adult user population and other demographic groups. In some cases, these design features can result in incorrect use of the drug delivery system and unacceptable risks.

Therefore, guidelines on the design input to the development of drug delivery systems specifically intended for administration of medicinal products by paediatric users are relevant. Especially, guidelines are relevant for development of those devices where the paediatric user is performing some or all use steps. The guidelines in this document are dedicated to those products. Guidelines in relation to the development of products intended for administration of medicinal products by caregivers only are not covered by this document as those devices are developed for the average adult population.

Due to the variation of design of drug delivery systems, this document does not specify requirements for developing, assessing and evaluating drug delivery systems.

Manufacturers should follow a risk-based approach during the design and development of drug delivery systems serving the paediatric population.

Figure 1 summarizes the applicability of this document.

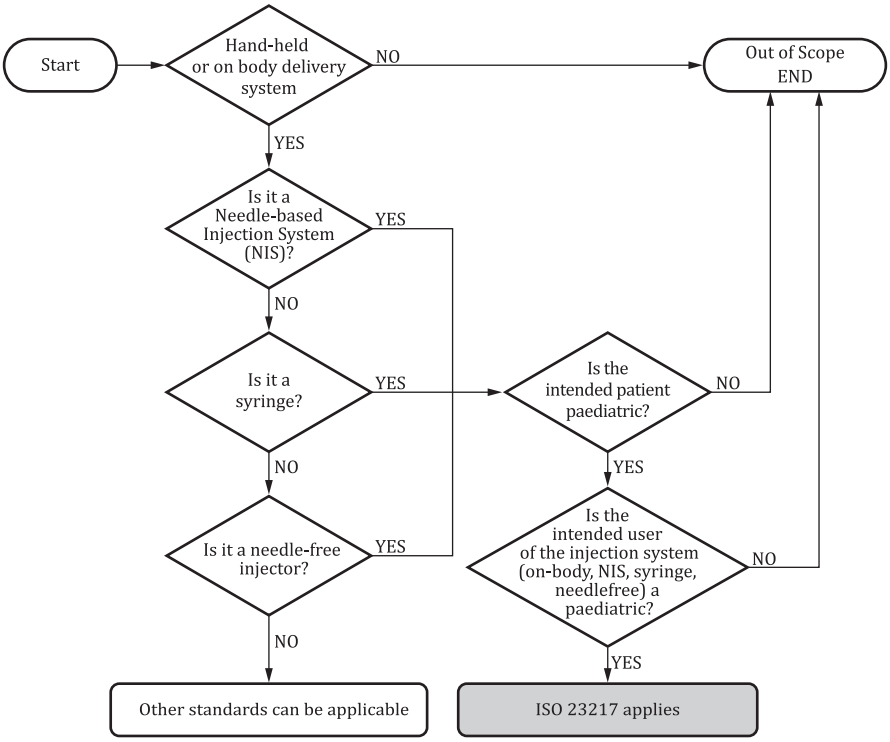

Figure 1 — Roadmap for the use of this document

Guidance on transition periods for implementing the content of this document is given in ISO/TR 19244.

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Injection systems for self-administration by paediatric patients — Requirements and guidelines for design

1 Scope

This document provides requirements and guidelines on the development of drug delivery systems intended for self-administration of medicinal products by the specific demographic group of paediatric patients who are performing some or all use steps required for their intended use.

Use steps include any handling action performed after the patient has received the product; these can include but are not limited to:

— transport – carrying the product while travelling (e.g. by walking, train, airplane, automobile, bus);

— storage – storage by the patient in their home, school, office or in temporary storage cases before or between uses;

— preparation – steps necessary to place the product in a state where it is ready to be administered;

— operation – steps necessary to initiate, adjust, pause, stop, or otherwise manage the delivery of medication using the product;

— maintenance – steps necessary to keep the product in good working order;

— disposal – steps to ensure safe disposal of the product after use (e.g. placement of the product in a suitable receptacle).

This document is applicable to injectable drug delivery systems for administration of medicinal products. Furthermore, this document can be useful for the development of other drug delivery devices or systems if they are intended for use by the paediatric population. Devices not in the scope of this document include catheters, for example those in the scope of ISO 10555 series, and infusion pump systems, e.g. IEC 60601-2-24 and aerosol delivery devices (ISO 20072).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13485, *Medical devices — Quality management systems — Requirements for regulatory purposes*

ISO 14971:2019, *Medical devices — Application of risk management to medical devices*

IEC 62366-1, *Medical devices — Part 1: Application of usability engineering to medical devices*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1
accompanying documentation
materials accompanying a medical device and containing information for the *user* (3.15) or those accountable for the installation, use and maintenance of the medical device, particularly regarding safe use

Note 1 to entry: The accompanying documentation can consist of the *instructions for use* (3.8), technical description, installation manual, quick reference guide, etc.

Note 2 to entry: Accompanying documentation is not necessarily a written or printed document but can involve auditory, visual, or tactile materials and multiple media types.

Note 3 to entry: Medical devices that can be used safely without instructions for use are exempted from having instructions for use by some authorities with jurisdiction.

[SOURCE: ISO 14971:2019, 3.1, modified — "decommissioning and disposal" have been deleted from the definition, and Note 3 to entry has been added.]

3.2
caregiver
non-professionals (e.g. family members, parents, guardians or friends) who provide care to the *patient* (3.11)

3.3
drug delivery system
medical device or system whose primary purpose is the administration of a medicinal product such as drugs and biologics

Note 1 to entry: This term applies to combination of components and subassemblies of the system that are intended to be integrated with the medicinal product with the purpose of providing a method of administration of the medicinal product.

[SOURCE: ISO 20069:2019, 3.1.2]

3.4
harm
injury or damage to the health of people, or damage to property or the environment

3.5
hazard
potential source of *harm* (3.4)

[SOURCE: ISO/IEC Guide 63:2019, 3.2]

3.6
health care provider
healthcare professional with proficient skills and experience with the use of a device so that they can aid or train patients and *caregivers* (3.2) to use and maintain the device

3.7
usability engineering
human factors engineering
UE/HFE
application of knowledge about human behaviour, abilities, limitations, and other characteristics to the design of medical devices (including software), systems and tasks to achieve adequate *usability* (3.13)

Note 1 to entry: Achieving adequate usability can result in acceptable *risk* (3.19) related to use.

[SOURCE: IEC 62366-1:2015, 3.17]

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3.8
instructions for use
IFU
directions provided by the manufacturer for the correct handling and operation of the *drug delivery system* (3.3)

[SOURCE: ISO 11608-1:2022, 3.10, modified — “needle-based injection system” replaced with “drug delivery system”.]

3.9
intended use
use specification
intended purpose
use for which a product, process or service is intended according to the specifications, instructions and information provided by the manufacturer

Note 1 to entry: The intended medical indication, patient population, part of the body or type of tissue interacted with, *user profile* (3.17), use environment, and operating principle are typical elements of the intended use.

[SOURCE: ISO/IEC Guide 63:2019, 3.4, modified — the preferred terms "use specification" and "intended purpose" have been added.]

3.10
paediatric
relating to children and/or adolescents

Note 1 to entry: The definition of paediatric varies by region and organization. See Annex A for different organizations’ classifications of “child” and “adolescent”.

3.11
patient
person undergoing a medical, surgical, or dental procedure

3.12
self-administration
process by which the *patient* (3.11) enters medication into their own body

3.13
usability
characteristic of the *user interface* (3.16) that facilitates use and thereby establishes effectiveness, efficiency and user satisfaction in the intended use environment

Note 1 to entry: All aspects of usability, including effectiveness, efficiency, and user satisfaction, can either increase or decrease safety.

[SOURCE: IEC 62366-1:2015, 3.16]

3.14
use error
user (3.15) action or lack of user action while using the medical device that leads to a different result than intended by the manufacturer or expected by the user

Note 1 to entry: Use error includes the inability of the user to complete a task.

Note 2 to entry: Use errors can result from a mismatch between the characteristics of the user, *user interface* (3.16), task, or use environment.

Note 3 to entry: Users can be aware or unaware that a use error has occurred.

Note 4 to entry: An unexpected physiological response of the *patient* (3.11) is not by itself considered use error.

Note 5 to entry: A malfunction of a medical device that causes an unexpected result is not considered a use error.

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[SOURCE: IEC 62366-1:2015, 3.21, modified — Note 6 to entry has been deleted.]

3.15
user
person interacting with (i.e. operating or handling) the medical device

Note 1 to entry: There can be more than one user of a medical device.

Note 2 to entry: Common users include clinicians, *health care providers* (3.6), *patients* (3.11), *caregivers* (3.2).

[SOURCE: IEC 62366-1:2015, 3.24, modified — Note 2 to entry has been changed.]

3.16
user interface
means by which the *user* (3.15) and the medical device interact

Note 1 to entry: User interface includes all the elements of the medical device with which the user interacts including *accompanying documentation* (3.1), packaging, and the physical aspects of the medical device as well as visual, auditory, tactile displays and is not limited to a software interface.

Note 2 to entry: A system of medical devices can be treated as a single user interface.

[SOURCE: IEC 62366-1:2015, 3.26, modified — Note 1 to entry has been deleted.]

3.17
user profile
summary of the mental, physical and demographic traits of a *user* (3.15) group, as well as characteristics, such as knowledge, skills and abilities, which can have a bearing on design decisions

[SOURCE: IEC 62366-1:2015/Amd 1:2020, 3.29]

3.18
residual risk
risk (3.19) remaining after *risk control* (3.21) measures have been implemented

[SOURCE: ISO/IEC Guide 63:2019, 3.9]

3.19
risk
combination of the probability of occurrence of *harm* (3.4) and the severity of that harm

[SOURCE: ISO/IEC Guide 63:2019, 3.10, modified — Note 1 to entry deleted.]

3.20
risk analysis
systematic use of available information to identify *hazards* (3.5) and to estimate the *risk* (3.19)

[SOURCE: ISO/IEC Guide 63:2019, 3.11]

3.21
risk control
process in which decisions are made and measures implemented by which *risks* (3.19) are reduced to, or maintained within, specified levels

[SOURCE: ISO/IEC Guide 63:2019, 3.12]

3.22
risk evaluation
process of comparing the estimated *risk* (3.19) against given risk criteria to determine the acceptability of the risk

[SOURCE: ISO/IEC Guide 63:2019, 3.14]

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4 Considerations for design inputs

4.1 General

The specific requirements that shall be fulfilled for a specific demographic population can partly be developed by applying the risk approach (see 4.2.1) and usability engineering (see 4.2.2) specified in applicable standards.

4.2 Risk assessment and usability engineering

4.2.1 Risk assessment

The manufacturer shall perform risk analysis, risk evaluation, risk control and an evaluation of residual risk acceptability in accordance with ISO 14971.

4.2.2 Usability engineering

A usability engineering program in accordance with IEC 62366-1 shall be applied. It shall include addressing use risks and tests and/or assessments throughout the development and as part of the design verification and design validation.

4.3 Considerations for the determination of requirements for the design of medical devices specific to paediatric users

4.3.1 Considerations in relation to risk (risk-based approach to design)

The risk assessment in accordance with ISO 14971 shall take into account the characteristics of the paediatric users including use risks in accordance with IEC 62366-1. See Table A.4 for examples of potential use errors.

4.3.2 Considerations in relation to human factors

4.3.2.1 General

During the design and development of a drug delivery system intended for self-administration by paediatric users, the intended uses, intended user profiles, and use environments shall be identified and clearly defined.

Based on the human factors' considerations, the requirements for the medical device shall be documented.

NOTE 4.3.2 highlights aspects of the HFE/UE process defined and documented in IEC 62366-1 that require special attention when developing drug delivery systems for paediatric use.

4.3.2.2 Characterization of the intended use

4.3.2.2.1 Intended user profiles

The socio-economic environment, cognitive and physical development, age and aptitude of the intended user shall be defined. Within the population of paediatric users, variation can be expected in terms of size, strength, stamina, skeletal maturity, coordination (e.g. gross and fine motor skills), visual, tactile, auditory and perceptual capabilities, emotional maturity, motivation, decision-making abilities and the impact of their medical condition on their ability to use the drug delivery system safely and effectively. Furthermore, if it is anticipated that a paediatric user needs the support of a healthcare provider or caregiver to use the drug delivery system, the limitations and capabilities of adult users shall also be defined.

4.3.2.2.2 Intended use environment

The environment of intended use shall be characterized. Paediatric users tend to lead active lifestyles and so some medical products are used outside of the home (e.g. at school or on sports fields). During these use

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scenarios they can be exposed to environmental factors (e.g. bright sunlight or excess temperatures) or used in a non-private setting.

4.3.2.3 Use-related risk

Manufacturers shall identify hazard-related use scenarios in accordance with IEC 62366-1, including potential use errors that can occur, identify known or foreseeable hazards and hazardous situations, and ensure that they are adequately controlled. When identifying and evaluating use-related risk, the content of the intended use shall be defined, and for drug delivery systems that are similar to the one under development with regard to use, the user interface or user interactions shall be analysed. The source of identification of potential use errors and risks can include human factors evaluations, literature research, and market experience.

4.3.2.4 User interface

4.3.2.4.1 General

When developing user interface requirements, the following aspects shall be evaluated.

It shall be evaluated how risks can be suitably controlled through the design of the drug delivery system including its associated materials. As covered in ISO 14971:2019, 6.2 the manufacturer shall use one or more of the following risk control options in the priority order listed:

a) inherent safety by design;

b) protective measures in the medical device itself or in the manufacturing process;

c) information for safety.

4.3.2.4.2 Design attributes

The characteristics of the paediatric user shall inform the design and development of a drug delivery system.

General drug delivery system design considerations are given in Table 1.

4.3.2.4.3 Training

While it is preferable to control risks through drug delivery system design, including associated materials, in some circumstances, mitigation by design alone can be insufficient for a paediatric population. In these situations, it can be appropriate to employ a training program. If training is a necessary component to mitigate risk of the drug delivery system, the manufacturer shall validate the effectiveness of the training program and justify how it is representative of the training that will be provided in commercial use of the drug delivery system.

The manner in which the training will be consistently implemented in the field shall be defined, however the risk of users not being trained shall also be assessed. For example, lay caregivers can learn how to use the system by observing a patient or another lay caregiver, and health care providers might not be directly trained.

4.3.2.4.4 Experience and knowledge of similar or other drug delivery systems

Paediatric users vary in their experience of managing their medication and of using similar drug delivery systems. Similarly, the knowledge and experience of their supporting health care provider or caregiver also vary. Therefore, the impact that both positive and negative knowledge transfer can have on safe and effective use of the drug delivery system shall be evaluated.

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4.3.2.4.5 Dose regime

The medical condition and thus dosing regimen can influence the drug delivery system design and shall be evaluated in relation to managing complexity.

For example, whether:

— the medication is a fixed dose or requires the user to set the required dose;

— training information is retained (e.g. if the medication is administered infrequently);

— the medication shall be given very frequently and/or at a fixed time of day, in a home environment or elsewhere.

4.3.2.4.6 Transportation, storage, preparation, operation, maintenance and disposal by the user

Requirements for transportation, storage, preparation, operation, maintenance and disposal of the drug delivery system shall be defined. E.g. if the medication is stored under refrigerated conditions, the circumstances under which temperature excursions can occur shall be identified when describing potential use scenarios.

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