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Implants for surgery — Cardiac pacemakers —

Part 2: Reporting of clinical performance of populations of pulse generators or leads

Implants chirurgicaux — Stimulateurs cardiaques — Partie 2: Établissement d'un rapport concernant le fonctionnement clinique de populations de générateurs d'impulsions ou de fils-électrodes

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 150, *Implants for surgery*, Subcommittee SC 6, *Active implants*.

This third edition cancels and replaces the second edition (ISO 5841-2:2000), which has been technically revised.

ISO 5841 consists of the following parts, under the general title *Implants for surgery — Cardiac pacemakers*:

— *Part 2: Reporting of clinical performance of populations of pulse generators or leads*

— *Part 3: Low-profile connectors (IS-1) for implantable pacemakers*

Introduction

ISO 14708-2:2012, 28.19 requires the clinician's manual to document the projected service life using defined settings. Expectations of available power-source energy are not always fulfilled, and changes in pulse-generator components and assemblies have resulted in an actual service life which is different from the projected service life. Defined production groups of pulse generators or leads have required closer follow-up or replacement due to changes in performance exhibited in clinical use.

Programmed settings and differing or changing patient therapy needs might also result in a device having more or less than the projected service life as defined by ISO 14708-2. In addition, clinical management and implant technique can have a significant impact on long term performance of lead and pulse generators. These variables are reflected in the product performance report data.

These factors underscore the value of maintaining an accurate and discriminating view of clinical performance of a population of devices within the scope of this part of ISO 5841, so as to aid patient management. In order to do this, it is necessary to collect implant and explant information as allowed by local law. Physicians and clinicians are encouraged to report their complaints and return associated explanted devices to the device manufacturers to support the accuracy of product performance reports.

It is recognized that certain devices are marketed in geographies where device implant and explant data are not available due to patient privacy laws. This situation requires manufacturers to apply alternative methods to calculate survival probability.

The primary purpose of this part of ISO 5841 is to describe the reporting responsibilities in sharing clinical performance information for patient management. When clinical performance reports discriminate by production group and focus on recent experience, they are of value in patient management.

This part of ISO 5841 concerns the clinical performance of devices, not the clinical reasons for their use. It is realized that reasons for use can be a guide in the design of future products.

Reporting parties can give cumulative clinical-experience information based on a variety of assumptions and statistical techniques. This part of ISO 5841 provides a method for categorizing devices, requirements for the statistical techniques (see Annex A) that shall be used to obtain the most benefit from the data and a statement of the rationale (see Annex B) for this part of ISO 5841.

Clinicians have emphasized that a device whose performance has changed, either expectedly or unexpectedly, is sometimes left implanted due to other medical considerations. Instances exist where the performance of a device has changed to stable but out-of-specification performance that is considered safe and effective by the attending clinician. This is an important reason why the term "failure" is avoided throughout the classification.

"Failure" is not sufficiently specific to express the significance of a change in performance. In addition, "failure" implies a negative connotation for pulse generators that meet all longevity claims and cease functioning due to normal power-source depletion.

Implants for surgery — Cardiac pacemakers —

Part 2:
Reporting of clinical performance of populations of pulse generators or leads

1 Scope

This part of ISO 5841 specifies requirements for reports on the clinical performance in humans of population samples of cardiac pulse generators or leads, intended for long-term implantation, hereinafter referred to as devices. Devices to be reported has to be market approved in one or more geographies. It includes general requirements for all reports and supplementary requirements for reports on cumulative experience with devices and estimates of future clinical performance for devices, when appropriate.

Annex A provides requirements for categorizing devices. It also provides normative requirements for statistical calculations, including a discussion of application of the results obtained. As with other statistical methods, the benefit of the analytical methods in this part of ISO 5841 is limited by the size of population under consideration. Annex B gives the rationale for this part of ISO 5841.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14708-2:2012, *Implants for surgery — Active implantable medical devices — Part 2: Cardiac pacemakers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14708-2 and the following apply.

3.1
advisory notification
<of a device> any action taken to inform the clinicians concerned by a manufacturer who has become aware that a device might fail to conform to any claims made relating to effectiveness, benefits, performance characteristics, or safety

3.2
clinical performance period
calendar period, defined by the reporting party, during which the clinical performance of a specific population sample of devices is assessed

3.3
complaint
any written, electronic, or oral communication that alleges deficiencies related to the identity, quality, durability, reliability, safety, effectiveness, or performance of a device after it is released for distribution[15]

3.4
confirmed malfunction
malfunction of an implanted device, confirmed by returned product analysis, not including induced malfunctions

3.5
damaged
<of a device> having characteristics which have changed outside the limits stated by the manufacturer, due to some external agency

3.6
device
cardiac pulse generators or leads, intended for long-term implantation

3.7
device family
specified group of device model numbers with the same indications for use and designs that differ only with respect to parameters not reasonably expected to significantly affect malfunction incidence or longevity, such as pulse generator header differences or lead length

3.8
follow-up centre
medical centre, hospital, clinic, or individual responsible for the care of a patient after the implantation of a device

3.9
implanted
status of a device after the surgical incisions are closed (implant pocket closed); if relevant clinical details are not available to the manufacturer, at least one calendar day shall have passed after the implant date in order to classify the device as implanted

3.10
implant damage — leads
damage which occurred after opening the lead package and during an attempt to implant the lead, i.e. the implant was not completed using the lead in question

3.11
induced malfunction — pulse generators
device malfunction caused by external factors (e.g. therapeutic radiation, excessive physical damage, etc.) including but not limited to hazards addressed in product labeling

Note 1 to entry: Damage to a pulse generator caused by a lead malfunction will be reported as a lead malfunction.

3.12
induced malfunction — leads
lead malfunction caused by use error or other external factors (e.g. scalpel cuts, damage caused during implant, sutures applied directly to lead body, explant or after explant etc.) including applications outside of labeling recommendations or addressed in product labeling as cautions or hazards in product labeling

Note 1 to entry: Damage to a lead caused by a pulse generator malfunction will be reported as a pulse generator malfunction.

3.13
in service
<of a device> functioning in such a manner as to provide potential medical benefits to the patient

Note 1 to entry: This term can apply to a device that may be out of specification (see 3.23).

3.14
in specification
<of a device> having characteristics within the limits recommended by the manufacturer for clinical use

3.15
lead modified — electrically
lead that remains connected to a pulse generator whose function is automatically altered or manually reprogrammed (e.g. changing from bipolar to unipolar or DDD to VVI mode) in response to a problem with the mechanical or electrical integrity of the lead

3.16
lead modified — surgically
any mechanical alteration of the lead (e.g. replacing a connector or the rate sensing portion of an ICD lead) in response to a problem with the mechanical or electrical integrity of the lead

Note 1 to entry: Does not include leads that have been successfully repositioned.

3.17
malfunction
failure of a device to meet its performance specifications or otherwise perform as intended

Note 1 to entry: Performance specifications include all claims made in the labelling for the device. The intended performance of a device refers to the intended use for which the device is labelled or marketed.[14]

3.18
malfunction without compromised therapy — pulse generator
pulse generator malfunction that did not compromise pacing or defibrillation therapy while implanted and in service

Note 1 to entry: Therapy is not compromised as long as the critical patient-protective pacing and defibrillation therapies are available. This includes changes in device settings that occur as intended by the design and do not result in loss of critical patient protective therapies but are the reported reasons for explant. Examples include (but are not limited to): reversion to a designed "safe mode", "backup mode", "power-on reset" or other manufacturer-specific terminology, error-affecting diagnostic functions, telemetry function, data storage, malfunction of a component that causes battery to lose power quickly enough to cause premature battery depletion, but slowly enough that the condition is detected through normal follow-up before therapy is lost; mechanical problems with connector header that do not affect therapy.

3.19
malfunction with compromised therapy
device malfunction causing compromised pacing or defibrillation therapy (including complete loss or partial degradation) while implanted and in service

3.20
medical reasons
reasons unrelated to the device or its operation

Note 1 to entry: Examples include (but are not limited to): Infection, extrusion, indication for an alternative medical device (e.g. the replacement of a single-chamber pacemaker in a patient with pacemaker syndrome with a dual-chamber pacemaker), etc.

3.21
normal battery depletion
for pulse generators, the condition when (a) a device is returned with no associated complaint and the device has reached its elective replacement indicator(s) with implant time that meets or exceeds the nominal (50 percentile) predicted longevity at default (labeled) settings, or (b) a device is returned and the device has reached its elective replacement indicator(s) with implant time exceeding 75 % of the expected longevity using the longevity calculation tool available at time of product introduction, calculated using the device's actual use conditions and settings

3.22
other conditions affecting performance — leads
non-electrical findings which do not affect clinical usage or outcomes, but might, for example, influence the length of a procedure

Note 1 to entry: Anomalous findings are those occasions where lab analysis reveals a secondary finding on a returned lead. These findings are not associated with a complaint. Examples include evidence of partial insulation abrasion, no conductor exposed or other cosmetic issues. Lead may have been successfully implanted.

3.23
out of service
<of a device> not providing a medical benefit to the patient

Note 1 to entry: A device thus described is not necessarily out of specification (see 3.24) or explanted.

3.24
out of specification
<of a device> having one or more characteristics outside the limits established by the manufacturer for clinical use

3.25
population sample
group of devices that is assumed to be representative of the worldwide population of implanted devices

Note 1 to entry: Typically, devices registered as implanted in the United States can serve as the population sample, but other data sources can be utilized, including, but not limited to remote monitoring and clinical studies.

3.26
post-approval surveillance study
enrollment of a sample of patients in identified centers for the purpose of prospective, active, systematic, scientifically valid collection, analysis, and interpretation of data, or other information, collected to report on device performance

3.27
post-market surveillance
activity performed by a manufacturer to assess product performance using analysis of complaints and returned products

3.28
premature battery depletion
for pulse generators, the condition when a device is returned and confirmed to have depleted the battery in a time period less than normal battery depletion

3.29
product performance report
document published by a pulse generator or leads manufacturer intended to report long term clinical performance of individual products

3.30
production group
population sample of devices designated by the manufacturer on the basis of a particular parameter

EXAMPLE Such a parameter may be, for example, time or place of manufacture or a change in the manufacturing process or components.

3.31
prophylactic explantation
explantation for reasons based on the anticipated performance of the device or other medical reasons

3.32
recommended replacement condition
condition in which the device exhibits characteristic(s) identified by the manufacturer as signalling that the device should be taken out of service

EXAMPLE A pulse generator that exhibits the maximum allowable changes in the battery-condition indicators stated by the manufacturer is in a condition where replacement is recommended.

3.33
registered explant
registered implant for which the date of explantation is known by the reporting party

3.34
registered implant
implanted device for which the date of implantation is known by the reporting party

3.35
registered implant month
one month of operation by a registered implant

3.36
reporting party
individual or organization publishing clinical pacemaker data or the analysis thereof

4 General requirements

4.1 Frequency of publication

Each manufacturer shall publish an updated performance report at least semi-annually. The report shall include data for the most recently completed clinical performance period.

4.2 Method of publication

Product performance reports shall be publicly available on the manufacturers' website.

4.3 Report organization

The product performance report shall be organized so that data are presented for each model or device family within the scope of this part of ISO 5841 that meet the inclusion criteria given in 4.4.

4.4 Criteria for inclusion and removal of reported models and device families

Models or device families shall be included in the product performance report at or before 500 worldwide sales.

Models or device families can be removed from the report when the earlier of the following occurs:

— fewer than 500 of the devices in the sample population are estimated (following corrections for under reporting) to remain in service;

— 20 years have elapsed since first market approval of the sample population.

4.5 Source of performance report data

Performance data can be obtained from various data sets, including, but not limited to post-market surveillance, registries, clinical studies, and remote monitoring. As a minimum, manufacturers shall utilize data obtained from post-market surveillance.

4.6 Product performance report — Required content

4.6.1 Textual and numeric data

For each model or device family being reported, the following data shall be provided in the product performance report:

a) model designation(s);

b) sources of the data and the methods used to collect them;

c) sample size and how the population and population sample are defined; if the manufacturer chooses to provide results segregated by sub-populations (e.g. production group, header differences, etc), the report shall explain the basis on which the sub-populations are established;

d) for the population described in item c), the number or percentage of devices that have been returned and analysed;

e) criteria for including and excluding data;

f) the clinical performance period;

g) units of time of the data;

h) category assigned to the device, in accordance with Annex A;

i) for devices subject to an advisory, the advisory description and associated recommendations shall be included if the number of devices susceptible to the anomaly described in the advisory is greater than 200. For these devices, the number of confirmed malfunctions for the affected sub-population shall be provided;

j) explanation of methods used to adjust for any sources of bias known to be present (see Annex A);

k) each report shall explain the presentation of the information and any methods of analysis used to calculate numerical expressions of performance. Any generalizations or inferences from data shall be qualified as to assumptions, limitations, and associated confidence levels;

l) the manufacturer shall disclose their level of conformity with this part of ISO 5841. Any non-conformities shall also be disclosed.

4.6.2 Estimated device survival probability

For each model or device family being reported, an estimate of the cumulative device survival probability derived through actuarial analysis using the method described in Annex A shall be provided. The results shall be presented in both graphical and tabular form. Graphical results shall be presented using consistent scales and sizes.

The report shall include, in addition to survival statistics, either effective sample size data for each time interval, or confidence limits, or both.

When the survival performance of a sub-population of devices subject to an advisory diverges from the population sample, survival curves for the sub-population should be shown separately.

Data for survival estimates can be collected using a prospective clinical study, remote monitoring, post market surveillance, or a combination of these or other methods.

The population for which cumulative survival probability is estimated for any given lead model or device family can be chosen by the manufacturer.

Manufacturers shall select methods that properly categorize devices in order to avoid problems affecting accuracy described in A.3.2.

