IMDRF International Medical Device Regulators Forum

Final Document

Title: Definitions for Personalized Medical Devices

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Preface

The document herein was produced by the International Medical Device Regulators Forum (IMDRF), a voluntary group of medical device regulators from around the world. The document has been subject to consultation throughout its development.

1.0 Introduction

The purpose of this IMDRF guidance is to establish harmonized definitions that are used to describe medical devices that are intended for a particular individual. The adoption of consistent, harmonized definitions for such medical devices could underpin a harmonized regulatory approach for controls on these devices and offer significant benefits to the manufacturer, user, patient, and to Regulatory Authorities. Eliminating differences between jurisdictions supports global convergence and decreases the cost of gaining regulatory compliance and allows patients earlier access to new technologies and treatments.

Technology has progressed from the time the original Global Harmonization Task Force (GHTF) foundation documents were published. It is now possible to produce medical devices that are individualized, for example, using additive manufacturing (3D printing) methods based on patient CT scans, on a commercial rather than artisanal scale. The original GHTF documentation does not adequately address devices of this nature.

Many jurisdictions already define the term custom-made device and have introduced exemption provisions for regulating custom-made medical devices with the intention to cover special cases where commercially available mass produced products are inadequate for the needs and requirements of a particular patient. In some jurisdictions, the exemption provisions were based on the premise that affected devices would largely comprise low risk products or limited use of higher risk implantable devices. In other jurisdictions the exemption provisions were established with the intention that numbers of custom-made devices would necessarily be small, due to the requirement for them to be used only in special cases.

Now regulators are faced with a very different environment. Technology has made "custom-made" devices, including implantable devices for particular patients, within reach on a much greater scale. Consequently, some jurisdictions are noticing questionable use of custom-made device exemptions; with growing numbers of patients receiving higher risk classification medical devices to meet their particular needs, under these exemptions.

2.0 Scope

This document applies to all medical devices, and is intended to identify and describe different categories of devices that are produced for the use of a particular individual, and also to define some other terms that are relevant to defining these types of devices.

3.0 References

GHTF/SG1/N68:2012 *Essential Principles of Safety and Performance of Medical Devices*

GHTF/SG1/N78:2012 *Principles of Conformity Assessment for Medical Devices.*

GHTF/SG1/N70:2011 *Label and Instructions for Use for Medical Devices.*

GHTF/SG1/N071:2012 *Definition of the Terms 'Medical Device' and 'In Vitro Diagnostic (IVD) Medical Device'*

GHTF/SC/N4:2012 *Glossary and definition of terms used in GHTF documents*

IMDRF/SaMD WG/ N10 FINAL:2013 *Software as a medical device (SaMD): Key Definitions*

ISO/ASTM 52900:2015 *Additive manufacturing — General principles — Terminology*

Regulations and Guidance documents from the organizations represented by all working group members were considered in the drafting of this document. For example:

Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017 on medical devices

USFDA CDRH, Technical Considerations for Additive Manufactured Devices - Guidance for Industry and Food and Drug Administration Staff, 5 Dec 2017

USFDA CDRH, Custom Device Exemption - Guidance for Industry and Food and Drug Administration Staff, 24 Sept 2014

Korea MFDS, Guidance for Patient-matched Medical Devices Manufactured using 3D Printers, 10 December 2015

4.0 Definitions

Definitions for personalized medical devices

4.1 **personalized medical device –** a generic term to describe any of the types of medical devices that are intended for a particular individual, which could be either a custom-made, patient-matched, or adaptable medical device.

4.2 **custom-made medical device – a medical device that, at a minimum, meets the following requirements:**

- it is intended for the sole use of a particular individual (which could be a patient or healthcare professional); and
- it is specifically made in accordance with a written request of an authorized professional, which gives, under their responsibility, specific design characteristics; even though the design may be developed in consultation with a manufacturer; and
- it is intended to address the specific anatomo-physiological features or pathological condition of the individual for whom it is intended.

Note 1: Medical devices that are patient-matched, adaptable or mass-produced shall not be considered to be custom-made.

Note 2: A custom made device is intended for a case where an individual's specific needs cannot be met, or cannot be met at the appropriate level of performance, by an alternative device available on the market.

4.3 **patient-matched medical device –** a medical device that meets the following requirements:

- it is matched to a patient's anatomy within a specified design envelope using techniques such as scaling of the device based on anatomic references, or by using the full anatomic features from patient imaging; and

- it is typically produced in a batch through a process that is capable of being validated and reproduced; and

- it is designed and produced under the responsibility of a manufacturer even though the design may be developed in consultation with an authorized healthcare professional.

Note 1: A written request from an authorized healthcare professional may be present; but is not mandatory.

Note 2: The number and type of design inputs in consultation with a healthcare professional may vary depending on the medical devices to be manufactured.

Note 3: The design must remain within the validated parameters of the specified design envelope.

4.4 **adaptable medical device –** a medical device that meets the following requirements:

- it is mass-produced; and

- it is adapted, adjusted, assembled or shaped at the point of care, in accordance with the manufacturer's validated instructions, to suit an individual patient's specific anatomo-physiologic features prior to use.

Definitions for the purposes of interpreting this document

4.5 **batch**

one or more components or finished devices that are produced using the same lot of raw material, the same method of manufacture, having the same probability of chemical or microbial contamination, and that are intended to have uniform characteristics and quality within specified limits

4.6 **DICOM files:**

patient imaging files, typically produced by computed tomography (CT) or magnetic resonance (MR), that are saved in the Digital Imaging and Communications in Medicine format.

4.7 **homogenous batch:**

a production group of equivalent parts or materials manufactured and/or tested in the same manner, without interruption, typically on the same day or in the same time period, and produced by the same person, or with the same machine/equipment set-up and fulfill the same specifications [Ref *MEDDEV* 2.5/6 Rev. 1 http://ec.europa.eu/DocsRoom/documents/10287/attachments/1/translations].

4.8 **mass-produced medical device:**

a medical device that is based on standardized dimensions/designs; that is not designed for a particular individual; and that is typically produced in a continuous production run or homogenous batch**.**

4.9 **specific design characteristics:**

unique design specifications, necessary to produce custom-made devices, that are based on an individual's specific anatomo-physiological features and/or pathological condition; and that cannot be proposed by a manufacturer without the involvement of a healthcare professional.

For example, transmitting only dimensions/geometric parameters (such as DICOM files from CT scans) to a manufacturer prior to the production of a medical device, is not sufficient to be considered as giving specific design characteristics. Additional information, such as the thickness and trajectory of a plate, the number, type and positions of fixation screws, would also need to be provided.

4.10 **specified design envelope:**

minimum and maximum dimensions, mechanical performance limits, and other relevant factors that characterize a medical device for production purposes, which may be based on a standard device template model.

Appendix

Examples of personalized devices

These examples are provided to further clarify the definitions in this document. Relevant concepts are illustrated in the explanatory text that is within each example.

Custom-made medical devices

- Artificial cervical disc replacement, requested by a spinal surgeon, for reconstruction of the cervical disc following cervical discectomy to treat cervical radiculopathy in a 7'2" male patient. In this example, the osseous dimensions of this patient's cervical spine exceed those which an available artificial cervical disc would accommodate; therefore the individual's specific needs cannot be met by an alternative device available on the market. The surgeon has provided, under his/her responsibility, unique design specifications that are based on the individual's specific anatomo-physiological features and pathological condition to the manufacturer.

- An acetabular cup implant requested by an orthopaedist who, in addition to DICOM-compliant scan images, sends to a 3D printing implant manufacturer specific requirements for acetabulum reconstruction by bridging the areas of acetabular bone loss. These include the thickness and trajectory of the cup mounting flange, and the number, type and positions of fixation screws. In this example these requirements are outside of the manufacturer's validated design envelope for this type of device. The required dimensions for bridging exceed those that have been validated under worst case parameters; and the number and location of screw holes are also beyond the limits modeled and/or tested.

- An endoscope with a modified steering mechanism requested by a gastroenterologist to address a loss in manual dexterity caused by a disability. In this example the individual's specific needs cannot be met by an alternative device available on the market. The relevant healthcare professional for the gastroenterologist provides under his/her responsibility shape and force design requirements to the endoscope manufacturer that address the special requirements related to the disability.

Patient-matched medical devices

- Acetabular guide designed to assist a surgeon with pre-operatively planned placement of the acetabular cup component of a total hip replacement. The guide is based upon CT images of a patient's specific anatomy and pre-operatively planned placement of the acetabular cup. The device manufacturing processes, as well as the pre-operative planning process upon which the design of the patient-matched guide is based, are validated within a certain range of anatomical parameters. In this example the guide is produced under the responsibility of the manufacturer in consultation with, and input from, the surgeon.

- Mandibular implants produced by a 3D printing manufacturer, from a template model and DICOM files. In this example the manufacturer provides software to the healthcare professional for the development of the 3D print file of the implant (based on the DICOM file from patient CT scans). The surgeon has received training from the manufacturer to use the software to tailor the 3D model for the patient within validated parameters. The manufacturer uses the 3D print file to produce, under its responsibility, the implant.

- An externally worn orthosis to shape the skull of an infant to prevent plagiocephaly, based on 3D external images of the patient's head. In this example the images are produced by a prosthetist and sent to a manufacturer. The manufacturer produces, under its responsibility, a patient specific helmet within validated parameters.

Adaptable medical devices

- Thoracolumbar pedicle screw system, which consists of multiple mass-produced components from a single manufacturer, that allows the surgeon to build an implant system, at the point of care, to fit the patient's anatomical and physiological requirements in accordance with validated instructions provided by the manufacturer. In this example the surgeon assembles a combination of hooks, screws, longitudinal members (e.g., plates, rods, plate/rod combinations), transverse or cross connectors, and interconnection mechanisms (e.g., rod-to-rod connectors, offset connectors). Additionally, longitudinal members require intraoperative contouring, in accordance with the manufacturer's validated instructions, in order to fit the individual patient's spinal curvature.

- Mass-produced polymer surgical implants for cranial reconstruction that are supplied sterile and are intended to be thermoformed during the surgical procedure. The manufacturer's validated instructions provide details for heating and shaping the implant to suit a patient's particular anatomy.

- Mandibular advancement orthosis for the treatment of sleep apnea, which is adapted to the dentition through thermoforming, and is adjusted by the patient in accordance with the manufacturer's validated instructions.