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ADDL Model for Device Analysis

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ABSTRACT

The purpose of this paper is to propose an analysis model to be used in device trials. The draft proposed model is currently being reviewed by the ADaM team and is not part of the ADaM model. The draft model has to accommodate the presence of more than one device per subject. These devices could be separately implanted, explanted, modified and controlled externally on the subject. The team analyzed various use-cases pertaining to analysis requirements of device data and presented a draft device model to the ADaM team for review. This paper discusses some of the variable metadata that could be used in the device analysis.

INTRODUCTION

FDA definition of medical device is:

- *"an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component part, or accessory which is:*
    - *recognized in the official National Formulary, or the United States Pharmacopoeia, or any supplement to them,*
    - *intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or*
    - *intended to affect the structure or any function of the body of man or other animals, and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes."*

A device does not achieve its purposes through chemical action within or on the body as a drug does it.

Medical devices treat conditions by physical means such as electrical, mechanical, magnetic or thermal action in contrast to pharmaceutical products that interacts chemically or biologically with the body. Medical devices are approved through Pre-Market Approval (PMA) application. Drugs are approved through New Drug Application (NDA) process.

Medical devices are approved by Center for Devices and Radiologic Health (CDRH) or Center for Biologics Evaluation and Research (CBER) at the FDA. Drugs are approved by Center for Drug Evaluation and Research (CDER) or CBER at the FDA.

Devices are classified as Class I, Class II and Class III devices. The classification is based on the safety and risk that could be caused by the device to the subject. Class I represents the least risky and most safe device and Class III represents the opposite end of the classification spectrum. Class II and Class III medical devices require regulatory approval on the safety and efficacy of the device.

SDTM implementation guideline for Medical devices provides guidance and standard domains for standardizing collected data about the device studies. The device domains are:

Device Identifiers – DI

Device-Subject Relationships – DR

Device Exposure – DX

Device Events – DE

Device Tracking – DT

Device-In-Use – DU

Device Properties - DO

PURPOSE OF ADAM MODEL FOR DEVICE ANALYSIS

The main purpose of a draft proposed ADaM model for devices is to standardize the analysis data structure, variables and naming conventions. This will facilitate data quality, patient safety and increase efficiency in the review of the analysis data by regulatory agencies. Standard data structures facilitates the review of the analysis data across trials and helps with the comparison of the analysis data against the predicate device data.

The purpose of Analysis Device model is to support per Subject per Device-level analysis of data. A subject could be associated with more than one device per trial. The device attributes that are collected in SDTM, like length, thickness, shape can be included in this dataset for analysis purposes.

DIFFERENCE BETWEEN ADSL AND ADDL MODEL

ADSL model is a subject level analysis model The ADSL metadata provides various attributes of the subject such as demographic data, population flag, date of exposure, disposition and death information.

The draft proposed ADDL model is defined at the level of subject and device. This permits the model to handle cases where multiple devices are used on the same subject. The device-level analysis information such as dates of device implantation, explanation, device re-positioning are defined at the device level. This device-level analysis information can be used in other ADaM datasets as needed.

OVERVIEW OF ADDL MODEL

COMMON DEVICE TERMINOLOGIES

Some of the common activities related to devices are device implants, explants, re-positioning, external activation and de-activation.

- Device implant is placing a device in the body by performing a procedure.
- Device explant is removing a device from the body by performing a procedure.
- Device re-positioning is re-adjusting the device position in the body after it is implanted.
- Device activation is activating the implanted device through a computer or a device monitor.
- Device de-activation is de-activating the implanted device through a computer or a device monitor.

DATASET METADATA

Dataset Name	Dataset Description	Dataset Structure	Purpose	Dataset Location	Key Variables of Dataset
ADDL	Device-Level Analysis	One record per Subject per Device	Analysis	addl.xpt	USUBJID,SPDEVID (Optional: ASPDEVID)

VARIABLE METADATA

The proposed variable metadata for ADDL are listed below.

The STUDYID, USUBJID, SUBJID and SITIEID are mapped from ADSL. Sponsor device identifier SPDEVID, is used to identify each device. ASPDEVID could be copied over from the SDTM variable SPDEVID or derived for analysis purposes.

Variable	Label	Type	Core	CDISC Notes
STUDYID	Study Identifier	Char	Req	ADSL.STUDYID
USUBJID	Unique Subject Identifier	Char	Req	ADSL.USUBJID
SUBJID	Subject Identifier for the Study	Char	Req	ADSL.SUBJID
SITEID	Study Site Identifier	Char	Req	ADSL.SITEID
SPDEVID	Sponsor Device Identifier	Char	Req	Copy SPDEVID from SDTM
ASPDEVID	Analysis Device Identifier	Char	Cond	Additional SPDEVID created to represent/identify the devices for analysis purposes. Eg: SPDEVID in SDTM might be a combination of manufacturer, type, Serial Number. ASPDEVID might be a combination of Serial number and form id
MFRGRy	Pooled Device Manufacturer Group y	Char	Perm	Character description of a grouping or pooling of devices for analysis purposes by device manufacturer. For example, MFRGR1 is the name of a variable containing device group (pooled device) names by device manufacture, where the grouping has been done according to the first device manufacturer grouping algorithm, defined in variable metadata.
MFRGRyN	Pooled Device Manufacturer Group y (N)	Num	Perm	The numeric code for MFRGRy. One-to-one map to MFRGRy.
TYPGRy	Pooled Device Type Group y	Char	Perm	Character description of a grouping or pooling of devices for analysis purposes by device type. For example, TYPGR1 is the name of a variable containing device group (pooled device) names by device type, where the grouping has been done according to the first device type grouping algorithm, defined in variable metadata.
TYPGRyN	Pooled Device Type Group y (N)	Num	Perm	The numeric code for TYPGRy. One-to-one map to TYPGRy.
MDLGRy	Pooled Device Model Group y	Char	Perm	Character description of a grouping or pooling of devices for analysis purposes by device model. For example, MDLGR1 is the name of a variable containing device group (pooled device) names by device model, where the grouping has been done according to the first device model grouping algorithm, defined in variable metadata.

MDLGRyN	Pooled Device Model Group y (N)	Num	Perm	The numeric code for MDLGRy. One-to-one map to MDLGRy.

AGEDSDT is the age at first exposure of each device. The subject's age at the first exposure of device A could be different than the exposure at device B. AGEDSDTU is required, if the age unit is different from ADSL.AGEU.

AGEDSDT	Age at First Exposure to Device	Num	Perm	Age of the Subject at First Exposure to Device
AGEDSDTU	Age Unit at First Exposure to Device	Char	Cond	Age unit for the Subject at First Exposure to Device. Required when the age unit is not the same as the age unit at ADSL

DEVICE VARIABLES

In the interest of space, only the date time variables are presented below. Separate variables for date, time and date and time imputation flags are defined in the proposed model.

DEVSDTM	Datetime of First Exposure to Device	Num	Cond	Date time of implant/ first exposure to device for a subject in a study. For Device only trials, the date/time of first exposure to device is recorded only in ADDL. The sponsor may choose not to populate TRTSDTM in ADSL. DEVSDTM could be the date of device implant or the date device turned-on. The definition of first exposure is determined as per analysis needs.
DEVEDTM	Datetime of Last Exposure to Device	Num	Cond	Date time of explant/ last exposure to device for a subject in a study. For Device only trials, the date/time of last exposure to device is recorded only in ADDL. The sponsor may choose not to populate TRTEDTM in ADSL. DEVEDTM could be the date of device explant or the date device turned-off or date of death. The definition of device last exposure is determined as per analysis needs.
DEVIPDTM	Datetime of Device Implant	Num	Perm	Date time of device implant, if different from date of first exposure to device
DEVXPDTM	Datetime of Device Explant	Num	Perm	Date time of device explant, if different from date of last exposure to device

DNzzSDTM	Datetime of Device Turn-On zz	Num	Perm	Date time the device under study is turned-on using a device monitor.
DFzzEDTM	Datetime of Device Turn-Off zz	Num	Perm	Date time the device is turned-off using a device monitor.
DRzzSDTM	Datetime Device Re-positioned	Num	Perm	Date time device re-positioned for a subject in a study. The device could be re-positioned but not completely explanted.
DMzzSDTM	Datetime Device Modified	Num	Perm	Date time device modified for a subject in a study. The device modification or maintenance could be done surgically or externally depending on the device. The device is not completely explanted.

Device first exposure date and device last exposure dates are determined by the sponsor as per their analysis needs. If the sponsor choose to define date of first/last exposure dates other than the device implant/explant dates, the date of device implant/explant can be defined separately in the proposed ADDL model.

Studies involving devices such as defibrillators might contain multiple devices implanted in a subject. The proposed model facilitates the representation of multiple activities in device studies such as device implants, explants, turn-on, turn-off, re-positioning devices in a standardized structure.

Some sponsors might choose to define the overall device turned-on, turned-off, re-positioned or modified date time values in ADDL. Others might choose to define all the date time values in ADDL. The sponsors can represent the data as per their analysis needs in the proposed model.

CONCLUSION

The proposed ADDL model facilitates the analysis of data at device-level rather than at subject-level. Use caution as this is a proposed structure being reviewed by the ADaM team. If submitted this may be used as an OTHER dataset but again is not currently an approved ADaM structure. Be sure to document in the Analysis Data Reviewers Guide for any non-standard structures.

The draft ADDL model is just the beginning for creating standard ADaM dataset structures for device analysis. We are hope to have more standard analyses structures and variable metadata to improve efficiencies and standardization of device analysis.

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