

## Introduction

In clinical trials, the collected data can be inconsistent and need to be corrected. The cleaning of data consists in identifying inconsistencies and sending appropriate queries to the investigator for data correction. With the use of EDC technology, checks can be directly applied on-line during the data collection, and the queries efficiently managed within the same application. However, off-line checks which are applied by the data manager on the study database using dedicated programs, are still widely used. SAS is an interesting alternative for implementation of these checks, especially in the working context of our company which is specialized in providing in-house fully integrated EDC solutions. Therefore, we have on the one hand an EDC solution which provides a sophisticated feature to write manual queries, and on the other hand, an efficient workflow for the implementation of off-line edit checks. Our motive for interfacing both sides is obvious and presented hereafter.

## Why still using off-line edit checks?

Most EDC solutions provide on-line edit-checks which is a rather effective way to reduce data errors and/or discrepancies at the time of data entry. Our EDC application (WEBEDM) which is a web-based application developed in Microsoft C#.NET enables efficient on-line edit checks during data entry as well. However several issues arise:

- the implementation of complex checks can become cumbersome
- it is not obvious to define if a correction should be mandatory or not

In our company we defined two types of checks as shown in figure below. In the first case, the inconsistency exists in the database and off-line query needs to be sent for correction.

|                                  |                                                                                             |
|----------------------------------|---------------------------------------------------------------------------------------------|
| <b>Informed consent</b>          |                                                                                             |
| Date of written informed consent | 13 / 05 / 2011 Today (dd/mm/yyyy)<br>Consent date is greater than visit date. Please check. |

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|----------------------|-----------------------------------------------------------------------------------|
| <b>Date of visit</b> |                                                                                   |
| Date of visit        | Today (dd/mm/yyyy) Visit date can't be greater than today's date. Please correct. |

Blocking (red) and warning (orange) on-line checks

## EDC queries management features

Our EDC application includes an intuitive query management module used during the data cleaning process by clinical research associates (CRAs), data managers and of course by investigators. Despite the customized features presented below, it becomes a challenge, especially in large studies, to manually generate all the data management queries, and automated process is required.

### Writing queries

The user ticks the inconsistent item inside the form, and positions the query so that other users can easily identify which data are inconsistent.

|                                  |                                                                                                           |
|----------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Date of visit</b>             |                                                                                                           |
| Date of visit                    | 05 / 04 / 2011<br>Question?                                                                               |
| <b>Informed consent</b>          |                                                                                                           |
| Date of written informed consent | Please specify/document<br>Please check<br>Please check and correct<br>Please provide indication<br>Other |

### Answering queries

The item concerned by the query is automatically highlighted. In case of correction, the user has direct access to the form.

|                                                                                                                         |              |
|-------------------------------------------------------------------------------------------------------------------------|--------------|
| DCF n°174 (Answered)                                                                                                    | Show info... |
| DCF n°224 (Pending)                                                                                                     | Hide...      |
| Please check and correct                                                                                                |              |
| <input type="radio"/> I confirm<br><input type="radio"/> I correct<br><input type="radio"/> Not applicable / Unsolvable |              |

|                                  |                |
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| <b>Informed consent</b>          |                |
| Date of written informed consent | 19 / 05 / 2010 |
| <b>Demography</b>                |                |
| Date of birth                    | 25 / 04 / 1985 |
| Age                              | 27             |
| Gender                           | Male           |

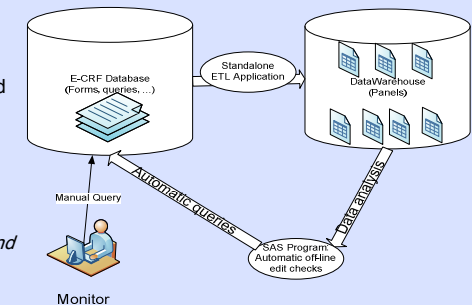
### Solving queries

From the investigator's answer, the CRA/DM can either close or send back the query. All users also have access to an adapted summary to navigate through the study queries.

## Interfacing SAS with EDC

The flexibility of SAS justifies partly the SAS implementation choice for off-line edit checks. Moreover, SAS programs are processed on a clinical structured database which first presents the advantage of being independent of the EDC application, and second allows rather complex edit checks to be implemented. Therefore, automatic edit checks controls can be applied by dedicated SAS programs on the updated structure database, and inconsistencies loaded by the EDC application.

Global architecture designed in our company, including EDC and structured data panels (Data warehouse)

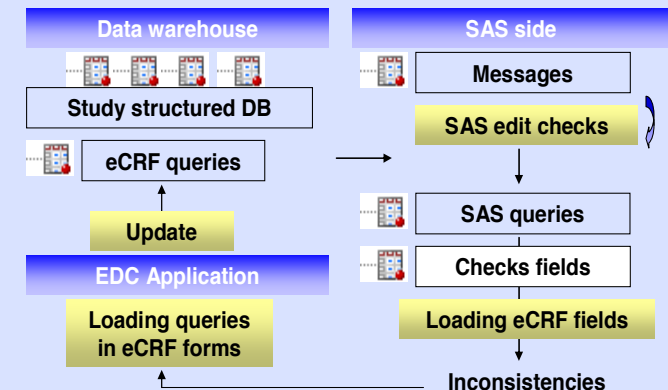


### Step 1 – Automatic sending of queries

Inconsistencies targeted by SAS programs are associated with appropriate identification items and queries messages; the SAS queries table is then updated. A SAS program loads new identified inconsistencies and associates the corresponding eCRF field to each query. All the information needed to generate on-line queries are exported and loaded within the application. On the EDC system side, automatic queries will be displayed exactly in the same way as if they were entered manually.

### Step 2 - Reconciliation

For completing the clean up process, the data manager has next to perform the reconciliation of eCRF queries and SAS inconsistencies during the trial which is easily managed with appropriate SAS programs.



## Conclusion

The integration of a SAS off-line edit checks management workflow with our EDC application is a concrete example of how the data management processes can be efficiently adapted to new eClinical technologies. The illustrated architecture enables full use of both the advantages of technologies used with the EDC system on the one hand, and the classical SAS programs on the other hand, resulting in the improvement of the overall data cleaning process. Working with in-house developed EDC applications offers interesting possibilities for further developments, and to extend this approach to other data management processes.