Service Availability and Readiness Assessment (SARA)

An annual monitoring system for service delivery

Implementation Guide
Acknowledgements

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Project Management Group
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Project Advisory Group
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7. Data processing
After data entry, data should be processed in order to compile all data into a single file as well as to check for inconsistencies and possible errors. Any inconsistencies or errors should be addressed and reconciled in order to create a final, clean data set that is ready for analysis.

Note: If the standardized SARA analysis tools are to be used, all data processing must be done in CSPro and the final, cleaned data file must be in CSPro format.

The following are the major steps that must be taken when processing and cleaning the SARA dataset:

1. Concatenation
2. Data cleaning
3. Data verification for completeness
4. Calculating sample weights
5. Calculating the SARA indicators
6. Exporting data

The following sections provide details on the SARA data cleaning and processing. These steps are based on the use of CSPro for data collection and data processing but they also provide some generic steps and principles.

## 7.1 Concatenation

### 7.1.1 Gathering data files into a single folder on a desktop/laptop computer

After the data has been captured electronically, the data files have to be moved to a single desktop or laptop computer for further processing. Copying data files from the data collectors’ computers to a back-up computer/laptop is usually done by the field supervisors (cf. Chapter 6 – Supervisor’s guide). It is also their responsibility to transfer data collected in the field to the central level.

At the end of the data collection, supervisors should have a folder for each team with the backup files:

```
SARA_TEAM1_DATE1
SARA_TEAM1_DATE2
SARA_TEAM1_DATE3
```

The latest file for each team should correspond to the final file. After validation by the supervisor, a copy of the final file should be created and renamed:

```
SARA_TEAM1_FINAL
```

The final data set should gather the final files from each team:

```
SARA_TEAM1_FINAL
SARA_TEAM2_FINAL
SARA_TEAM3_FINAL
```

Note: If the standardized SARA analysis tools are to be used, all data processing must be done in CSPro and the final, cleaned data file must be in CSPro format.
This final data set should be transferred to the data manager/focal point at central level in charge of the compilation of the data from field collection. A back-up of all data files (final and stamped with dates) should precisely be saved as back-up and remain accessible during the cleaning and data processing phase.

A USB flash can be used to transfer data from the supervisors’ computers to the data manager/focal point at the central level.

When all data have been transferred, there should be only one final data folder enclosing all data files from all the field teams:

<table>
<thead>
<tr>
<th>SARA_TEAM1_FINAL</th>
<th>SARA_TEAM2_FINAL</th>
<th>SARA_DATA_COLLECTION_FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>(...)</td>
<td>SARA_TEAM25_FINAL</td>
<td></td>
</tr>
</tbody>
</table>

### 7.1.2 Data concatenation

If the CSPro data entry application has been used, the data will need to be concatenated into a single data file before any further processing can be done.

If CSPro has been used, the “Concatenate Data” tools in CSPro can be used for these purposes. Before consolidating the data files, any duplicate facility ID’s should be identified. If there are two or more data files containing the same exact facility ID’s, CSPro will not be able to consolidate the files since no two cases are allowed to have identical ID items. If there are duplicates one copy should be deleted prior to consolidating the data files. For step-by-step instructions on Concatenation in CSPro, please refer to Chapter 4 – CSPro.

### 7.2 Data cleaning

#### 7.2.1 Tracking facilities

Once all the data has been concatenated, the first step in the review process is to take stock of the data and determine what has been collected. It is important to check that all facilities in the sample have been covered, and if not, to keep track of those that are missing. An excel sheet such as the following should be kept by the supervisors during the field data collection to help for this process:

| A | B       | C         | D         | E         | F         | G         | H         | I         | J         | K         | L         | M         | N         | O         | P         | Q         | R         | S         | T         | U         | V         | W         | X         | Y         | Z         |
|---|---------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1 | Facility ID/Zone | District | COUNTY (ZOE) | SUB-COUNTY | MARA/MAA | HEALTH UNIT | OWNER | AUTHORITY | LEVEL | STATUS | POA | Validation Comments |
| 2 | 3D00050 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 3D00039 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 3D00034 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | 3D00035 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | 3D00036 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | 3D00037 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | 3D00038 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | 3D00039 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 3D00040 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | 3D00041 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | 3D00042 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 | 3D00043 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | 3D00044 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | 3D00045 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | 3D00046 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17 | 3D00047 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 | 3D00048 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19 | 3D00049 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 3D00050 | Central & L.P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

In this example, green is highlighting facilities that were in the original data set and have been assessed. It also indicates that data collectors have entered data in CSPro and data has been validated (as per the steps described in the following section). The facilities highlighted in blue are replacement facilities. It is important to
indicate which of the facilities from the original sample have been replaced. Finally the facilities in red are those which could not be assessed- information on why the facility could not be assessed should be enclosed in the tracking table.

This information is extremely useful in understanding what happened during the field data collection as per the original plan. This information will also be very helpful later when calculating sample weights.

### 7.2.2 Reviewing data files

Each data files should be opened and the following key items checked:

- Facility name and ID number correspond to each other
- Facility ID information is correct (facility type, managing authority, as per the master facility list)
- The data collector ID is correct
- All forms have been fully completed
- Empty cases have been deleted
- Duplicate cases have been identified and reconciled
- “Other” responses have been recorded as applicable
- Geographic coordinates checked (if applicable)
- Supervisor validations compared with originals and reconciled

If errors are found in the facility name, facility ID number, facility type, or managing authority, etc. these should be corrected. Key items should be reviewed as follows (based on electronic data collection using CSPro):

#### Reviewing facility identification

Reviewing facility identification is the first step in data cleaning. It consists on validating the name of the facility and its corresponding identification code, type, managing authority and location as defined in the country master facility list. If any updates have been made to the facility identification during the field data collection all these changes should be captured in the log of the facilities surveyed (as described in the previous section). This will assist the supervisor and other people in charge of the data handling to understand the facility identification and why it differs from the initial master facility list.

It is also important to make sure that the interviewer ID is properly entered. In some cases, the data processors will find discrepancies that need to be reconciled and will need to contact the team responsible or the original data collection. Having the interviewer ID properly recorded greatly facilitates this process.

#### Reviewing completeness of a case

It is important to verify that all forms of a case (CSPro electronic version of the paper questionnaire) have been filled properly. The completeness of a case should be verified prior to leaving the facility and double-checked by the supervisor when backing-up the data so that any gaps can be identified and completed if necessary.

#### Recode “other” responses as applicable

All responses that have “other, please specify” as an answer option should be reviewed to make sure that the response written in the “other” category does not fall into one of the pre-coded categories. If the “other” response does fall into one of the pre-coded categories, it should be recoded as such.

*For example:* Section 4 - Infrastructure / question Q418: “What is the most commonly used source of water for the facility at this time?”
7. Data processing

- The response has been recorded as “Other” and Q418_A has been recorded as “Piped into facility” which is an option in the answer options for Q418.
- The response for Q418 should be updated to “1- Piped into facility”

Delete any empty cases

Occasionally a case will be stored by accident that contains no data. These cases should be removed from the data set.

Final check for any duplicate cases

Duplicate cases are cases with the same facility code. If two cases appear to be duplicates according to facility name, but do not contain the same data, a list of criteria must be used to determine if it is a true duplicate. The following data elements could be used as the criteria for determining duplicates:

- district
- facility code/name
- GPS coordinates (if collected)
- facility type
- managing authority
- interviewer’s code.

If these are all the same it is safe to consider the cases as duplicates. At this point, the most complete case should stay in the data set. If both cases are complete, the case with latest time stamp should be kept.

Check the validity of GPS coordinates if applicable

GPS coordinates should be checked to ensure that they fall within the boundaries for the country. Sometimes latitude and longitude coordinates can be entered incorrectly. All GPS coordinates should be double-checked to ensure they are valid for the area being surveyed.

For example, all facilities in Kenya should fall within the following ranges:

Latitude: 5°N and 5°S (-5.0000 to 5.0000 in decimal degrees)
Longitude: 34° and 42°E (34.0000 to 42.0000 in decimal degrees)

One common mistake is to not record properly the positive (+) and negative (-) values for coordinates. North and East coordinates should be positive (+). South and West coordinates should be (-). Another common mistake is to reverse the recording of longitude and latitude coordinates. Review and edit the GPS coordinates using the same method used above for reviewing and editing the key items for each facility.

If CSPro has been used for the data collection, steps for reviewing/editing data are available in Chapter 4 – CSPro.
7.2.3 Identify supervisor validation records and reconcile with original record

If supervisor validations have been conducted, it is important to identify them in the data set and make sure they have been labelled correctly (Q002). A comparison between the supervisor validation record and the original record should be done and any differences reconciled so that there is ONE record per facility in the final data set. Step-by-step instructions on using the CSPro Compare Data Tool to compare two data files and identify the differences is available in Chapter 4 – CSPro.

7.2.4 Dependent verification if survey was conducted on paper and entered into CSPro at a later time (if applicable)

Dependent verification is used to check that the electronic data are consistent with the responses in the paper version of the questionnaire. When you verify a case, you key the case a second time as if you were in Add mode. Even though there is already data in the data file, CSEntry does not show this to you. All fields on the current form start out blank. Each time you key a field, the system compares the value you keyed with the value in the data file. If these two values match, you move to the next field. If the values do not match, you get a message telling you so. When this happens, simply rekey the field. One of the following situations will occur:

- The second value you key matches the value in the data file. The system assumes your first value is in error and moves to the next field. There will be no change to the data file for this field.
- The second value you key matches the first value you keyed. The system assumes the value in the data file is in error and moves to the next field. The new value, which you keyed twice, will replace the original value in the data file.
- The second value you key matches neither the value in the data file nor the first value you keyed. The system will throw away the first value you keyed, show you the mismatch message and wait for you to rekey the field again.

For details on verifying cases, see Chapter 4 – CSPro.
7.3 Data verification for completeness

Once the data files have been concatenated, it is possible to run a specific application in CSPro to track data inconsistencies, allowing more in-depth data cleaning and validation. The application will help identifying questions not answered that should have been answered and on the other hand, track questions that shouldn’t have been answered but were based, on the specific skip patterns. For more details on the data verification application for completeness, please refer to Chapter 4 - CSPro.

7.4 Calculating sample weights

Sample weights are adjustment factors applied in tabulations to adjust for differences in probability of selection between units in a sample, either due to design or chance. Whether or not sample weights are necessary, as well as how to calculate the sample weights, is determined by the survey methodology implemented. For the SARA survey, if a health facility census methodology is used, no sample weights are necessary. If a health facility sample methodology is used, sample weights will be necessary unless a strictly proportional sampling scheme is used in which every unit in the sample has an equal probability of selection.

The recommended sampling methodology for SARA is to cover all hospitals, thus having an oversampling of hospitals, and to have a nationally and regionally representative sample of lower-level facilities. It is also recommended that the facilities be stratified by facility type and managing authority. Data must be weighted during analysis to account for oversampling and to ensure the results reflect the actual distribution of facilities in the country.

The process of producing sample weights occurs after data collection, once the data have been processed and cleaned for analysis. They cannot be generated until after fieldwork is completed since they are applied to the final sample of respondents and computing them relies on final outcome information from data collection.

7.4.1 Calculating sample weights

The following information is needed to calculate sample weights:

- stratification variables used to partition the sampling frame (i.e. were facilities stratified by region, facility type, managing authority, etc.);
- the number of facilities in the sampling frame (i.e. total number of facilities in the country) by stratum;
- the number of facilities in the selected sample by stratum.

To calculate the sample weights, begin by creating a table with columns as shown in Table 1.1.

Table 1.1 Sample weight calculations: table layout

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratification variable 1</td>
<td>Stratification variable 2</td>
<td>Stratification variable 3</td>
<td>Number of facilities in the sampling frame</td>
<td>Number of facilities in the sample</td>
<td>Weight</td>
</tr>
</tbody>
</table>
Fill in Columns A–E with the information from the survey methodology. For example, if the sampling methodology was to stratify by region and facility type, the regions would be displayed in Column A and the facility types would be displayed in Column B. The number of facilities in the sampling frame that correspond to the specified strata would be given in Column D, and the number of facilities in the sample that correspond to the specified strata in Column E. Column F, the sampling weight, is the inverse of the probability of selection of the sample units by stratum, and is calculated as Column D / Column E, or the number of facilities in the sampling frame divided by the number of facilities in the sample.

Table 1.2 provides example data for a SARA survey implemented in country X. Facilities in the sampling frame are stratified by region and facility type. There are four regions (coded 1–4) in the country and five facility types (coded 1–5). Column C is empty because there are only two stratification variables, and therefore can be deleted. If there are four or more stratification variables, additional columns would need to be added after Column C.

Table 1.2 Sample weight calculations: example data

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratification variable 1</td>
<td>Stratification variable 2</td>
<td>Stratification variable 3</td>
<td>Number of facilities in the sampling frame</td>
<td>Number of facilities in the sample</td>
<td>Weight (Column D / Column E)</td>
</tr>
<tr>
<td>Northern (1)</td>
<td>Hospital (1)</td>
<td>3</td>
<td>3</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health centre (2)</td>
<td>45</td>
<td>7</td>
<td>6.429</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health post (3)</td>
<td>87</td>
<td>11</td>
<td>7.909</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maternal child health post (4)</td>
<td>132</td>
<td>16</td>
<td>8.250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clinic (5)</td>
<td>5</td>
<td>3</td>
<td>1.667</td>
<td></td>
</tr>
<tr>
<td>Southern (2)</td>
<td>Hospital (1)</td>
<td>6</td>
<td>7</td>
<td>0.857</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health centre (2)</td>
<td>60</td>
<td>9</td>
<td>6.667</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health post (3)</td>
<td>68</td>
<td>9</td>
<td>7.556</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maternal child health post (4)</td>
<td>283</td>
<td>35</td>
<td>8.086</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clinic (5)</td>
<td>6</td>
<td>4</td>
<td>1.500</td>
<td></td>
</tr>
<tr>
<td>Eastern (3)</td>
<td>Hospital (1)</td>
<td>4</td>
<td>4</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health centre (2)</td>
<td>61</td>
<td>9</td>
<td>6.778</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health post (3)</td>
<td>66</td>
<td>8</td>
<td>8.250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maternal child health post (4)</td>
<td>179</td>
<td>23</td>
<td>7.782</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clinic (5)</td>
<td>7</td>
<td>5</td>
<td>1.400</td>
<td></td>
</tr>
<tr>
<td>Western (4)</td>
<td>Hospital (1)</td>
<td>7</td>
<td>5</td>
<td>1.400</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health centre (2)</td>
<td>29</td>
<td>3</td>
<td>9.667</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health post (3)</td>
<td>15</td>
<td>3</td>
<td>5.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maternal child health post (4)</td>
<td>29</td>
<td>4</td>
<td>7.250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clinic (5)</td>
<td>3</td>
<td>1</td>
<td>3.000</td>
<td></td>
</tr>
</tbody>
</table>

Once the weights have been calculated, they need to be added to the final data set. Determine the stratum that each facility belongs to and then assign the appropriate weight. For example, using the weights calculated in Table 1.2, if a facility is a health centre in the Northern region, it would be assigned a weight of 6.429.
7.5 Calculating SARA indicators

SARA indicators can be calculated manually or using other software. Step-by-step approach on calculation of SARA indicators is available on the Chapter 8 – Data analysis. If CSPro has been used for the data collection, a Batch Edit application for generating the SARA indicators is available. It contains logic that you can apply against one set of files to produce another set of files and reports. For the SARA we will use a batch edit application to create additional variables, specifically the SARA indicators.

For the SARA questionnaire, all the SARA indicators have been placed in the data dictionary and a batch edit application has been created to assign the values to each indicator based on the responses to the questions in the questionnaire. If changes have been made to the SARA core questionnaire, these changes will need to be reflected in the batch edit application. Defined stratum and calculated weights (if applicable) will also need to be added to the batch to reflect country specificities.

For detailed step-by-step on calculating SARA indicators using the CSPro batch edit application, please refer to the Chapter 4 – CSPro.

7.6 Exporting data from CSPro

Once the indicators have been generated in CSPro, they should be exported for analysis. CSPro has a built-in Export Data application that allows you to quickly and easily export data in a variety of formats. For the SARA data, the CSProExport data application will be used to export the SARA indicators to a txt file. It can then be opened, viewed and saved in Microsoft Excel (XLS). For more details on exporting data from CSPro please refer to Chapter 4 - CSPro.