

# NEMSIS Version 2 to Version 3 Translation – User Guide

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## **Overview**

This user guide provides instructions on using resources published by the NEMSIS TAC for translating NEMSIS data from version 2 to version 3. The resources include a database of element and value mappings, a data dictionary, and Extensible Stylesheet Language Transformation (XSLT) files to transform version 2 data to version 3.

## **Disclaimer and Limitations**

This product is provided by the NEMIS TAC, without charge, to facilitate a data mapping between NEMSIS version 2.2.1 and NEMSIS version 3.3.4. The primary target audiences are state employees maintaining EMS databases and software developers interested in enhancing the value of legacy data systems. In most instances, mapping between the two standards is straightforward. For those instances in which mappings are not direct, the NEMSIS TAC relied on our history and experience to confirm an approach to mapping. Neither the NEMSIS TAC nor any employees associated with the TAC are responsible for any perceived “lost data” or “inappropriate” associations detailed in the mapping. By utilizing this program, users accept the decisions and approach taken to provide this mapping.

Users should read this user guide in its entirety prior to using this product. This user guide contains information about important limitations in translating NEMSIS data from version 2 to version 3. The Data Dictionary also contains important comments regarding specific element mappings and value mappings. Users should carefully review the data dictionary pages that are relevant to their projects in order to determine whether any mapping decisions may impact the results of their work.

## Requirements

Database: Microsoft Access 2007 or higher.

Data Dictionary: A PDF reader.

XSLT Files: An XSLT processor that implements XSLT version 2.0.

NEMSIS XML Data: The transformations require valid NEMSIS version 2.2.1 data and produce valid NEMSIS version 3.3.4 data.

## Installation

The resources are provided as a ZIP archive that can be unzipped to any location. The archive contains the following folders and files:

- v2v3ValueMapping/ (main folder)
  - includes/ (folder containing files required by the XSLTs)
  - NEMSIS\_V2\_V3\_Translation.accdb (database)
  - NEMSIS\_V2\_V3\_Translation\_Data\_Dictionary.pdf (Data Dictionary)
  - NEMSIS\_V2\_V3\_Translation\_User\_Guide.pdf (this User Guide)
  - v2v3EMSDataset.xml (XSLT for EMSDataSet)
  - v2v3EMSDemographicDataSet.xml (XSLT for EMSDemographicDataSet)

## Processing Files with XSLT

The XSLT files require an XSLT processor that implements XSLT version 2.0. A schema-aware (SA) processor is not required.

A NEMSIS version 2.2.1 EMSDataSet file can be transformed to a NEMSIS version 3.3.4 EMSDataSet file using v2v3EMSDataset.xml. An example command using the Saxon XSLT processor is as follows:

```
[path/to/saxon/]Transform
-s:[v2source.xml]
-xs1:v2v3EmsDataSet.xml
-o:[v3output.xml]
```

A NEMSIS version 2.2.1 EMSDemographicDataSet file can be transformed to a NEMSIS version 3.3.4 DEMDataSet file using v2v3EMSDemographicDataSet.xml. An example command using the Saxon XSLT processor is as follows:

```
[path/to/saxon/]Transform
-s:[v2source.xml]
-xs1:v2v3EmsDemographicDataSet.xml
-o:[v3output.xml]
```

(The commands shown above are broken into multiple lines for clarity but should be typed on one line.)

Please read the rest of this user guide before processing data. It is important to understand limitations and additional preparatory work that may be required.

## Using the Data Dictionary

The data dictionary can be viewed in any PDF viewer. Each page contains information about the mapping from a version 2 element and its values to a version 3 element and its values. The page consists of two columns:

- Left Column: version 2 information
- Right Column: version 3 information

The following information is shown in both columns:

- The element's XML name and NEMESIS name
- The element's data type
- Whether the element accepts null/not values
- Whether the element is nillable
- The minimum and maximum recurrence allowed for the element
- Comment (applies to the mapping between the two elements or data types)
- Mapping:
  - V2 Pattern (a version 2 pattern that is to be mapped to version 3, and also a label if the value is a code from an enumerated list)
  - V3 Replacement (a version 3 value or an XPath instruction for transforming the version 2 value to a version 3 value, and also a label if the value is a code from an enumerated list)

As indicated above, some V2 Patterns and V3 Replacements are expressions written using XPath code. In particular, a dot (.) represents the contents of the version 2 element. For example, a V2 Pattern of “<=4000000” means that the contents of the version 2 element must be less than or equal to 4 million; a V3 Replacement of “substring(.,1,25)” means the first 25 characters of the contents of the version 2 element. In some cases, both the V2 Pattern and V3 replacement are simply a dot (.), which means that all possible values in the version 2 element are simply copied as-is into the version 3 element. A V2 Pattern of “otherwise” signifies the value mapping used if the contents of the version 2 element do not match any of the other V2 Patterns in the Mapping list. If questions arise regarding the V2 Pattern or V3 Replacement expressions, refer to an XPath language reference for further documentation.

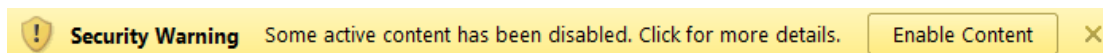
The Mapping list is sorted by order of precedence. If a particular version 2 value matches multiple V2 Patterns, the first match is used.

The presence of comments on a data dictionary page, either for the element mapping or for a value mapping, indicates that there are limitations or some level of subjective judgment in the mapping. Users should review the comments carefully to ascertain whether they agree with the mappings or wish to modify or remove the mappings.

## Using the Database

Software developers may wish to use the database to modify mappings or extract information for software or database development. For information regarding the design of the database, including tables, columns, and relationships, see the “Relationships” view in “Database Tools” and the “Design” view for each table within the database.

Microsoft Access may display the following security warning when opening the database:



The database contains some features that import and export files. Those features will only work if active content is enabled. Active content does not need to be enabled in order to browse or edit data.

The database is set to ANSI-92 compatibility mode.

The database presents a navigation form when opened. The form lists the following actions in three tabs. The actions preceded by an asterisk require active content to be enabled.

- Documentation
  - View Mapping Data Dictionary: View the data dictionary as a Microsoft Access report.
  - \*Create PDF of Mapping Data Dictionary: Export the data dictionary as a PDF, overwriting the PDF file included with this product.
  - \* View User Guide: View this user guide.
- Edit (see "Editing Mappings" below)
  - Edit mapping table for:
    - City
    - Current Medication
    - Medical/Surgical History
    - Medication
    - Medication Allergy
    - Null/Not Values (Advanced)
    - All Other (Advanced)
  - \*Import Cities from File
- Export (see "Exporting Mappings" below)
  - \*Export All Mapping Files
  - \*Export mapping file for:
    - City
    - Current Medication
    - Medical/Surgical History
    - Medication
    - Medication Allergy
    - Null/Not Values (Advanced)
    - All Other Lookups (Advanced)
    - Expression-based Mapping (Advanced)
    - Custom Configuration (Advanced)
    - Element Mapping (Advanced)

## Editing Mappings

The database contains mappings that have been identified by the NEMSIS TAC. However, there are some circumstances where a developer may need to edit the mappings.

### City

Version 2 specifies the use of the Federal Information Processing Standard 55-3 (FIPS 55-3) for city codes, but it allows any string of length 2 to 30. Version 3 specifies the use of GNIS Feature ID and limits

the codes to positive integers. City mapping entries are not included in this product, except for one example mapping entry. If City mapping is needed, it is necessary to add entries to the City mapping in the database and export them. Entries can be added or edited manually, or they can be loaded from a file. The file must be a pipe-delimited text file obtained from the "State Files with Federal Codes" section at [http://geonames.usgs.gov/domestic/download\\_data.htm](http://geonames.usgs.gov/domestic/download_data.htm) and saved in the same folder as the database with the name "FedCodes.txt".

City codes are always mapped in concert with State codes. Thus, if a City is provided for a particular address but a State is not, no mapping will be performed for that City code.

If multiple mappings exist for a FIPS code within a state, priority is given to codes with a census class code that starts with "C", then "P".

### **Current Medication**

Version 2 allows a string of length 2 to 30. Version 3 allows a string of length 2 to 7 and specifies the use of RxNorm. Current Medication mapping entries are not included in this product, except for one example entry. If Current Medication mapping is needed, it is necessary to add entries to the Current Medication mapping in the database and export them.

### **Medical/Surgical History**

Version 2 allows a string of length 2 to 30 and specifies the use of ICD-9. Version 3 specifies a pattern and specifies the use of ICD-10. Medical/Surgical History mapping entries are not included in this product, except for one example entry. If Medical/Surgical History mapping is needed, it is necessary to add entries to the Medical/Surgical History mapping in the database and export them. The Centers for Medicare and Medicaid Services (CMS) provides "General Equivalence Mappings" (GEMs) as a resource to map from ICD-9 to ICD-10. The files can be obtained from the "ICD-10-CM and GEMs" menu items at <http://www.cms.gov/Medicare/Coding/ICD10/>. (This product does not provide an automated option for loading Medical/Surgical History mapping entries from a file.)

### **Medication**

This mapping handles medications that are carried by an agency or administered on a patient care report. Version 2 allows a string of length 2 to 30. Version 3 allows a string of length 2 to 7 and specifies the use of RxNorm. Mapping has already been performed for 150 medication values representing 96% of medication administrations with mappable medication names in the National EMS Database. However, it may be necessary to add more entries to the Medication mapping in the database and export them.

### **Medication Allergy**

Version 2 allows a string of length 2 to 30. Version 3 specifies a pattern and specifies the use of ICD-10 Z88.\* or RxNorm. Medication Allergy mapping entries are not included in this product, except for two sample entries (one that maps to an ICD-10 code and one that maps to an RxNorm code). If Medication Allergy mapping is needed, it is necessary to add entries to the Medical/Surgical History mapping in the database and export them.

### **Null/Not Values**

Mapping has been performed to translate version 2 Null Values to version 3 Not Values. It is unlikely that there would be situations that would require changes to this mapping.

## All Other

All value mappings other than the ones listed above are contained in a single table in the database. For most mappings, it is unlikely that there would be situations that would require changes. However, if the version 2 data being translated do not conform strictly to the national NEMSIS XML schema, but instead use a customized schema, then mapping entries may need to be adjusted for those data types that are different from the national schema.

EMS personnel licensure/certification levels represent one particular area that may require additional mapping entries. Several data types in version 2 enumerate licensure/certification levels but also allow any string of length 2 to 100. The enumerated values have been mapped; however, if the version 2 data being processed contain other values, it is necessary to add entries to the value mapping for all data types that are related to EMS personnel licensure/certification levels in the database and export them.

Mappings in this table can be entered as literal values or as XPath expressions (in all other tables listed above, only literal values are allowed). Literal values are matched using a lookup, and the version 3 replacement may contain XML tags. If a mapping is entered using XPath expressions, then the “isExpression” column should be set to “true” for that row, and both the V2 Pattern and V3 Replacement must contain a valid XPath expression. XML special characters should not be encoded/escaped; they are encoded during export.

A special value of “otherwise” is allowed in the V2 Pattern; if it is used, the “isExpression” column must be set to “true” for that row, and there must be at least one other row containing an expression-based mapping for that data type pair. The row with the V2 Pattern of “otherwise” provides a V3 Replacement that is used if the version2 value does not match any of the other mapping entries.

The “order” column can be set to specify mapping precedence when a version 2 value matches more than one pattern and only one version 3 replacement is allowed. Expression-based mappings are evaluated before literal values. Within each set (expression-based mappings or literal values), the mapping with the lowest value for “order” takes precedence. A mapping with a V2 Pattern of “otherwise” is always evaluated last.

## Exporting Mapping Files

If any mappings are changed, the XSLT files created for the mappings must be updated. This can be done by selecting “Export All Mapping Files” on the Export tab of the navigation form in the database. Or, if only one mapping was modified, that one mapping can be exported. The exports update the files that are in this product’s “includes” folder.

## Modifying Transformation Files without Using the Database

The database provides a user interface for editing mappings. However, it is also possible to directly edit the mapping files in the “includes” folder of this product, all of which are XML. For details, refer to the information in “Editing Mappings” above.

The transformation files can be used without the database or documentation. If the XSLT files are moved or embedded in another system, it is necessary to retain the “includes” folder and all of its files with the main XSLT files.

## Notes on Mapping Version 2 Enumerated Lists to Version 3 External Standards

There are several mappings where the version 2 data type is an enumerated list and the version 3 data type references an external standard. In all but one of these mappings, a NEMSIS 3 “suggested list” exists for the version 3 data type. For some version 2 values, it may be possible to map to a version 3 value that is on the suggested list, but there may be a more precise match from the external standard that is not on the suggested list. The following describes the general approach taken on each mapping.

- **Cause of Injury, Environmental/Food Allergy, Incident Location Type, Procedure, and Symptom:** Values that are on the suggested list are preferred. Values from outside of the suggested list are used only when there is no reasonable match on the suggested list.
- **Condition Code Number:** There is no suggested list. The Centers for Medicare and Medicaid Services (CMS) has not released any resources for ICD-10-based EMS condition codes, but it has released “General Equivalence Mappings” (GEMs) the map from ICD-9 to ICD-10. The GEMs were used for most mappings as long as they were reasonable within the context of EMS; otherwise, a more precise match was chosen.
- **Provider’s Impression:** Values that are on the suggested list are preferred. Values from outside of the suggested list are only used when there is no reasonable match on the suggested list. The version 2 impressions data type includes many values that actually represent signs and symptoms. Those values are mapped to version 3 impressions, since that is where they were originally recorded in the version 2 data.

## One-to-many and Many-to-one Mapping

In some cases, a single version 2 value maps to multiple version 3 values. If the version 3 element is allowed to have multiple instances, then the translation will generate all of the values in the version 3 data. For example, a version 2 exam/assessment finding of “Soft Tissue Bruising/Swelling” is mapped to both “Swelling” and “Contusion” in version 3.

In some cases, a version 2 element that contains multiple values must be mapped to a version 3 element that only allows a single value. In those cases, the matches are prioritized and the highest-priority match is used.

## Custom Elements

Some version 2 elements do not exist in version 3 (e.g., E08\_09 Scene Zone Number). They are mapped by generating version 3 custom elements.

Some version 2 elements have specific values that do not exist in version 3 (e.g., the “Patient Loaded” procedure). For a small number of values that add little or nothing to the interpretation of the data, no mapping is performed. For all other values, version 3 custom elements are used.

## Other Notes

Typographic errors existing in the version 2 and version 3 schema files are not corrected in this product.

The structure of the version 3 data and the instructions to map a specific version 2 element to a specific version 3 element are coded in the XSLT files; they cannot be changed in the database without also manually editing the XSLT files.

In most cases within the transformations, insignificant whitespace (“whitespace-only text nodes” in the XML standard) is stripped, and all other whitespace is normalized (removing leading, trailing, and redundant whitespace). One exception is the PCR narrative, where all whitespace is retained.

The following elements are hard-coded in the EMSDemographicDataSet translation because they are mandatory in version 3 and it is not possible to map them from the information available in version 2:

- dConfiguration.11 EMS Agency Specialty Service Capability: Set to “None”.
- dConfiguration.13 Emergency Medical Dispatch (EMD) Provided to EMS Agency Service Area: Set to “Yes, 100% of the EMS Agency's Service Area”.

The “Status” attribute available in some elements within the version 2 EMSDemographicDataSet is ignored. Data are translated regardless of whether the “Status” attribute is set to “A” (active) or “I” (inactive).

In version 2 Prior Aid contains a mix of medications and procedures, which are mapped to version 3 medications and procedures respectively. If a value for Prior Aid does not map to either a medication or a procedure, it is excluded.

The XSLT files contain code comments that may be useful to software developers.

## Conclusion

The NEMSIS Version 2 to Version 3 Translation contains resources to assist in various tasks related to mapping data from NEMSIS version 2 to 3. The XSLT files may be used by an XSLT processor to transform data from version 2 to 3. The data dictionary may be used to visualize, document, and communicate the mapping from version 2 to 3. The database may be used to view and modify the transformation mappings. And, the content of the database tables may be used in software and database development.