**Author R. Snelick, NIST - Context-based Test Data Categorizations – Working Document**

**DRAFT 8 04/19/2016**

**Write-up for book content.**

Context-based Test Data Categorizations

The case study for testing a sending application’s ability to create laboratory results messages includes use of NIST-defined test data categories and an associated method for testing the message content. This approach was used in the 2014 Edition of ONC certification testing. Based on this experience applying basic data categories for conformance testing, NIST has developed more granular categories, which are used in the latest testing framework (including the 2015 Edition ONC certification test tools). Assigning test data and discrete assessment categories to elements provide a mechanism that enables expanded testing of a specification’s messaging requirements and of the data element content as well. The data categories associated with the message elements are, in essence, an additional conformance assessment indicator that is focused on content. Test case authors can use this method to create targeted test cases for probing a sending application’s capabilities.

As explained earlier, a mechanism is needed to bind a specific test data category to test data and to show users which categories have been applied. In some cases, the test tool validator (based on the test data categorization) simply examines the message element for the presence of data, whereas in other cases the validator examines the message element for the presence of data and for exact content. For the HL7 v2.x conformance testing tool presented, a Message Content Data Sheet is used to show which categories are assigned to each data element. Figure 1 shows an example of the Message Content Data Sheet listing the location, data element, test data, and the associated test data categorization.

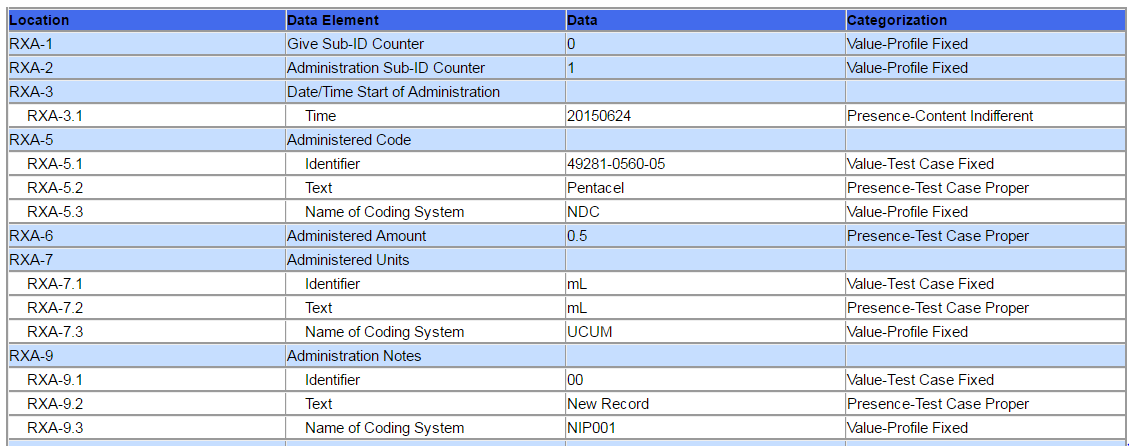


Figure1: Example Message Content Data Sheet for RXA Segment (Immunization)

Table 1 shows descriptions of the test data categories (Indicators) and the testing implications associated with use of each category. The test data categories enable classification of the test data in order to extend and strengthen the rigor of the testing. For each category, the table lists the criteria that are used by the test tool to assess the test data that populate each element in a message. These criteria in turn tell the tester whether or not the test data in a specific element can be changed, the source of the test data, and to what level of precision the validation tool will assess the data. A common example for extending the testing capability involves message elements specified with a Usage of RE (Required, but maybe Empty). Context-based testing must be used when the tester wishes to assess the system's ability to support these elements, because without context (test data provided) an automated validation tool has "limited ways of knowing" whether the data needed for the RE data element are available for use in the message or not. Using a test case and associated categorized test data, the tester can inform the validation tool (and the user) of the conformance expectations for this message element. In the case of assessing an application's ability to support an element with RE usage, the category assigned would be "Presence", which notifies the tester and validation tool that data shall be present in the message for this element.

Table 1: Test Data Categorization: Descriptions and Testing Implications

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **Description** | **Testing Implications** | **Comments** |
| **Indifferent** | No test data are provided as part of the test case. | No additional validation. | The validation is indifferent to the presence of data or specific content in the message element.  **Meaning:** Value or don't value this data element. |
| **Presence** | Test data are provided as part of the test case; content indifferent. | Validated for the presence of data. | The specific content is not pertinent to the test cases for the purpose of testing. The test data can be modified.  **Meaning:** Value this data element. |
| **Presence-Length** | Test data are provided as part of the test case; minimum length of the content is expected. | Validated for the presence of data to a minimum length. | The specific content is not pertinent to the test cases for the purpose of testing, but the length of the content is. The test data can be modified as long as the minimum length of the test data is maintained.  **Meaning:** Value this data element to a minimum length. |
| **Value** | Test data are provided as part of the test case; specific content is provided and expected. | Validated for the presence of data and for specific content. | The specific content (or choice of content) is provided and is expected to be present in the message. The test data can only be modified with data in the allowable data set. In some cases, the set is a single constant.  **Meaning:** Value this data element with the test data options provided. |
| **Non-presence** | No test data are provided as part of the test case and no content for this message element is expected. | Validated for the non-presence of data. | Content is not specified in the test case and is not expected to be present in the message.  **Meaning:** Don't value this data element. |

The test data categories provide a classification scheme for defining the impact that the test data given in a test case have on the validation of message instances. The use of test data expands the scope of message validation. For each test case, test data are given that coincide with the test story. The test case developer uses the test data categories as an aid to assess vendor product capabilities required by the implementation guide in the context-based testing operation mode (such requirements can't be tested easily in a context-free environment). The Qualifier (Table 2) provides a refinement of the test data category and provides additional information about the source of the data and expectations of the data element. The Qualifier does not have an impact on the validation of the data element.

To keep this discussion brief, the test data categories presented here address only data elements with R (Require) and RE (Required, but may be Empty) usages. The method applies equally to other usage indicators, however, most context-based testing focuses on elements with R and RE usage. Elements with C (Conditional) usages resolve to either R, RE, O, or X usages based on the outcome of the condition predicate. The test case developer will provide (or not provide) data to trigger the various conditional outcomes, hence, data elements with C usage for a specific test case resolve to another usage and are handled as described above for that specific usage. The test case developer can use this mechanism to ensure that each conditional will be triggered.

Table 2: Test Data Categorization with Qualifiers and More Details

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **Description** | **Qualifier** | **Description** |
| **Indifferent** | No content is specified. | ***None*** | None |
| **Presence** | Example content is specified. | ***Content Indifferent*** | Content is expected to be present in the message, but not a specific value. |
| ***Configuration*** | Content is expected to be present in the message, but not a specific value. The value is usually determined at installations. |
| ***System Generated*** | Content is expected to be present in the message, but not a specific value. The value is system generated. |
| ***Test Case Proper*** | Content is expected to be present in the message, but not a specific value. However, content is expected to be consistent with the clinical test story. |
| **Presence-Length** | Example content is specified to a minimum length. | ***Same Qualifiers as for Presence*** | Content of a minimum length is expected to be present in the message, but not a specific value. |
| **Value** | Specific content is specified. | ***Profile Fixed*** | Content is defined as a constant in the conformance profile. The constant is specified in the test data. |
| ***Profile Fixed - List*** | Content is defined as a set of allowable values in the conformance profile. One value from the allowable set is specified in the test data. |
| ***Test Case Fixed*** | Content that is defined as a constant in the test case. |
| ***Test Case Fixed - List*** | Content is defined as a set of allowable values in the test case. One value from the allowable set is specified in the test data. |
| **Non-presence** | No content is explicitly specified. | ***None*** | None |

Table 3 provides additional information about the testing implications the test data categorization has on the conformity assessment. The table also provides insight regarding when a particular category should be used.

Table 3: Test Data Categorization: Testing Implications and Use

|  |  |
| --- | --- |
| **Test Data Categorization Assessment Indicators** | |
| **Indifferent** | |
| **Testing Implications** | None  R 🡪 None  RE 🡪 None |
| **Use/Examples** | Data are not provided as part of the test case. No assessment of the data element is made beyond that specified in the standard. Usually applies to elements with RE usage in which valuing the element, or not, is not of interest for the test case. |
| **Presence** | |
| **Testing Implications** | 1. The presence of content is being assessed by the validation tool. 2. Specific content is not being assessed by the validation tool.   R 🡪 None  RE 🡪 Validates for the presence of data. |
| **Use/Examples** | R: Indicates the characteristic of the test data given and expected in the vendor message.  RE: Data are provided for use in the test case to test whether the vendor product supports the element. Indicates the characteristic of the test data given and expected in the vendor message.  The characteristic type of the data is further described by the qualifier. |
| **Presence-Length** | |
| **Testing Implications** | 1. The presence of content is being assessed by the validation tool. 2. The length of the content is being assessed by the validation tool. 3. Specific content is not being assessed by the validation tool.   R 🡪 Validates the length of the data for a minimum value  RE 🡪 Validates for the presence of data and the length of the data for a minimum value |
| **Use/Examples** | Example data are provided for the test case, specific content is not of interest, but the minimum length of the content is.  Example use: Tests that the vendor product supports the PID-5.3 (Second and Further Given Names or Initials Thereof) element to a certain length. |
| **Value Profile-Fixed** | |
| **Testing Implications** | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the conformance profile.   R 🡪 None  RE 🡪 Validates for the presence of data. |
| **Use/Examples** | The value is defined as a constant in the conformance profile. That constant is provided in the test data. The validation of the content is accounted for in the profile constraints; no additional assertion is needed for Required elements. For RE elements, a presence check is required. A typical use is when the constant is required when an RE element is present. |
| **Value Profile-Fixed List** | |
| **Testing Implications** | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the conformance profile.   R 🡪 None  RE 🡪 Validates for the presence of data. |
| **Use/Examples** | The value is defined as a set of allowable values in the conformance profile. One value in this set is provided as the test data. The validation of the content is accounted for in the profile constraints; no additional assertion is needed for Required elements. For RE elements, a presence check is required. A typical use is when the constant is required when an RE element is present. |
| **Value Test Case Fixed** | |
| **Testing Implications** | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the test case.   R 🡪 Validates for specific content  RE 🡪 Validates for the presence and data specific content |
| **Use/Examples** | A specific value for this data element is specified in the test case and that specific value is expected in the message. The test case developer is requesting a specific value to assess support for a certain value that is in the scope of the defined requirements (e.g., a specific coded value); to trigger a certain workflow or function; or to enable subsequent test steps in a test case. |
| **Value Test Case Fixed List** | |
| **Testing Implications** | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the test case.   R 🡪 Validates for specific content  RE 🡪 Validates for the presence and data specific content |
| **Use/Examples** | A specific value from a set of values for this data element is specified in the test case and one of the values from that set is expected in the message (not necessarily the specific value given in the test data). The test case developer is requesting one value from a set of values to assess support for a certain set of values that is in the scope of the defined requirements (e.g., a coded value defining a concept); to trigger a certain workflow or function; or to enable subsequent test steps in a test case. |
| **Non-Presence** | |
| **Testing Implications** | 1. The non-presence of content is being assessed by the validation tool.   R 🡪 N/A  RE 🡪 Validates for the non-presence of data |
| **Use/Examples** | Content is not specified in the test case and is not expected to be present in the message. Typically applies to data elements with RE usage for which the test case developer wishes to ensure that the implementation doesn’t provide a default value in the message when no data is available. |

Data Content Conformity Assessment Examples

Table X shows how the test data categories can be applied in practice. For example, the first row indicates that the usage is “RE” and the test case provides “Donna” as the test data. Since the test category is “Presence Content-Indifferent” there is an expectation that the element be valued. If that element is not valued in the message, then the validation result is “Fail”. The second row indicates that a value is present, therefore, the result of the validation is successful. To emphasize the point of Presence Content-Indifferent, the third row shows that the data in the message is “Sue”, and the result of the validation is successful (because, the assessment indicator is looking for only presence, not exact content).

Table 4: Test Data Categorization: Testing Implications and Examples of Use

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Element** | **Usage** | **Test Data** | **Test Data Category** | **Conformity Assessment** | **Data in Message** | **Validation Result** |
| PID-5.3  (Middle Name)[[1]](#footnote-1) | RE | Donna | Presence Content-Indifferent | Required | <Empty> | Fail |
| PID-5.3  (Middle Name) | RE | Donna | Presence Content-Indifferent | Required | Donna | Pass |
| PID-5.3  (Middle Name) | RE | Donna | Presence Content-Indifferent | Required | Sue | Pass |
| PID-5.3  (Middle Name) | RE | Donna | Presence-Length Content-Indifferent | Required  Min Length = 5 | Victoria | Pass |
| PID-5.3  (Middle Name) | RE | Donna | Presence-Length Content-Indifferent | Required  Min Length = 5 | Sue | Fail |
| PID-5.3  (Middle Name) | RE | Donna | Value-Test Case Fixed | Required  Value = Donna | Donna | Pass |
| PID-5.3  (Middle Name) | RE | Donna | Value-Test Case Fixed | Required  Value = Donna | Sue | Fail |
| PID-5.3  (Middle Name) | RE | <Empty> | Indifferent | Indifferent | <Empty> | Pass |
| PID-5.3  (Middle Name) | RE | <Empty> | Indifferent | Indifferent | Donna | Pass |
| PID-5.3  (Middle Name) | RE | <Empty> | Non-Presence | Forbidden | Donna | Fail |
| MSH-9.2  (Trigger Event) | R | V04 | Value-Profile Fixed | Required  Value = V04 | V04 | Pass |

In contrast, when examining the sixth and seventh rows of the table, the assessment indicator is now set to Value-Test Case Fixed for the same usage/test data scenario. In the case where “Donna” is expected (seventh row), the message with content of “Sue” now fails. As shown in these examples, use of the test data categories and their associated assessment implications provides a systematized method for expanding testing capabilities, not only for the technical requirements but also for specific content.

Table 5: Use of Test Data Categorization for Coded Elements

|  |  |  |  |
| --- | --- | --- | --- |
| **Element[[2]](#footnote-2)** | **Test Data** | **Test Data Category** | **Conformity Assessment** |
| RXA-5.1  (Identifier) | 49281-0560-05 | Value-Test Case Fixed | Content must be present and exactly “49281-0560-05”. |
| RXA-5.2  (Text) | Pentacel | Presence-Test Case Proper | Content must be present and indicate a value equivalent to “Pentacel”. |
| RXA-5.3  (Coding System) | NDC | Value-Profile Fixed | Content must be present and exactly “NDC”. |

Table 5 presents an example of how a coded element can be tested using test data categories. Based on the test story, data for a newly administered immunization for Pentacel using the NDC code system (instead of CVX) are entered into the SUT. The Identifier “49281-0560-05” is expected to appear in the message exactly as given, the associated Text needs to be equivalent to the concept of “Pentacel”, and the Code System must be exactly “NDC”.

Testing Cardinality

As demonstrated, the test data category methodology addresses the conformance constructs of usage, length, and content (specifically, vocabulary). Support of multiple occurrences is tested in a similar fashion using test data, and no additional special mechanism is necessary. If the cardinality of an element is, e.g., [0..3], test data can be provided for 0, 1, 2, or 3 occurrences. The test data and associated test data category assessment indicators provide sufficient information such that a validation can be performed. For example, if the specification indicates a cardinality of [0..3] for phone number, a test case could be created in which data for two phone numbers were given.

**10/14/2015 Draft 6 (added Error Descriptions for validation test tool—at the END)**

**Updated: 11/17/2015 – updated TCAMT error messages**

**Original Version 05/04/2014**

**TABLE 1 - For Public Facing for ONC Certification Documentation**

The test data categories provide a classification of the test data for a test case and is used to extend testing capabilities. The classification aspect provides characteristics of the test data such as whether or not the test data can be changed, the source of the test data, and what level of validation will be assessed on the data. A common example for extending the testing capability is for message elements specified with RE (Required, but maybe Empty). In such a case, the Tester wishes to assess the system’s capability for assessing support for this element. Without context, an automated validation tool, is limited in the assessment for support of an element with RE usage. Using a test case and associated test data, the Tester can provide test data for this element and inform the validation (and the user) of the expectations of conformance for this message element by assigning a test data category. In the case of assessing a system’s capability for support an element with RE usage, the assignment would be “Presence”. This indication notifies the validation that data shall be present for this message element.

Rewording:

The test data categories enable classification of the test data in order to extend and strengthen the rigor of the testing. Each classification category defines the criteria that are used by the test tool to assess the test data that populate each field in a message. These criteria in turn tell the tester whether or not the test data in a specific field can be changed, the source of the test data, and to what level of precision the validation tool will assess the data. A common example for extending the testing capability involves message elements specified with a Usage of RE (Required, but maybe Empty) Context-based testing must be used when the Tester wishes to assess the system’s ability to support these elements, because without context (test data provided) an automated validation tool has no way of “knowing” (change to limited ways) whether the data for the RE data element are available for use in the message or not. Using a test case and associated categorized test data, the Tester can inform the validation tool (and the user) of the conformance expectations for this message element. In the case of assessing a system’s capability for support of an element with RE usage, the category assigned would be “Presence”, which notifies the Tester and validation tool that data shall be present for this message element.

The context-based testing approach...NEED to bring in some of the context-free and context-based diagrams, etc. for better explanation and how all of this fits in.

**Testing implications** indicates how the message content is validated by the test tool based on the data categorization assignment.

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Data Categorization** | **Description** | **Testing Implications** | **Comments** |
| **Indifferent** | No test data is provided as part of the test case. | No additional validation. | The validation is indifferent to the presence of data or specific content in the message element.  **Meaning: Value or don’t value this data element.** |
| **Presence** | Test data is provided as part of the test case; content indifferent. | Validated for the presence of data. | The specific content is not pertinent to the test cases for the purpose of testing. The test data can be modified.  **Meaning: Value this data element.** |
| **Presence-Length** | Test data is provided as part of the test case; minimum length of the content is expected. | Validate for the presence of data to a minimum length. | The specific content is not pertinent to the test cases for the purpose of testing, but the length of the content is. The test data can be modified as long as the minimum length of the test data is maintained.  **Meaning: Value this data element to a minimum length.** |
| **Value** | Test data is provided as part of the test case; specific content is provided and expected. | Validate for the presence of data and for specific content. | The specific content (or choice of content) is provided and is expected to be present in the message. The test data can only be modified with data in the allowable data set. In some cases, the set is a single constant.  **Meaning: Value this data element with the test data options provided.** |
| **Non-presence** | No test data is provided as part of the test case and no content for this message element is expected. | Validate for the non-presence of data. | Content is not specified in the test case and is not expected to be present in the message.  **Meaning: Don’t value this data element.** |

**Issue with TABLE 1** is that there are qualifiers that are not given in the table. A reference (explanation) to the qualifiers has to be made since they will appear in the Message Content sheet.

**TABLE 2**

**Test Case Categories: User Information**

The **Test Data Categories** provide a classification scheme for defining how the test data given in a test case impacts the validation of message instances. The use of test data expands the scope of message validation. For each test case, test data is given that coincides with the test story. The test case developer uses the test case categories to assess vendor capabilities required by the implementation guide in the context-based testing operation mode (such requirements can’t easily be tested in a context-free environment). The **Qualifier** provides a refinement of the test data category and provides additional information of the source and expectations of the data element. The qualifier does not impact the validation of the data element.

The test data categories apply only to data element with R (Require) and RE (Required, but may be Empty) usages. Data elements with usages of O (Optional) and X (Not-supported) are not considered for this testing. In the future they may be considered, for example, to assess the receiver’s capability to react to message with errors, and X element will be valued (and a test data category of Error will be created). Elements with C (Conditional) usages resolve to either R, RE, O, or X usages based on the outcome of the condition predicate. The test case developer will provide (or not provide) data to trigger the various outcomes. Hence, data elements with C usage for a specific test case resolves to another usage and is handled as described above for that specific usage.

Things to do:

1. Simplify table for specification in the test procedures, and other tool documentation.
2. More detailed explanations of each (with examples) in supplemental information to the table. Provide very specific examples.
3. Plain English explanation of the constraints being added and the relationship to the requirements already checked from profile requirements.
4. Indicate that the Qualifier is only informational and doesn’t impact validation. For test case proper an important signal is being given that the data should be sound (otherwise, some systems may prevent message creation because it verifies data).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test Data Categorization** | **Description** | **Qualifier** | **Description** | **Testing Implications** | **Use/Examples** |
| **Indifferent** | No content is specified. | ***None*** | None | None  Additional Assertions Made:  R 🡪 None  RE 🡪 None | Data is not provided as part of the test case. No assessment of the data element is made beyond that specified in the standard. Usually applies to elements with RE usage in which valuing the element, or not, is not of interest for the test case. |
| **Presence** | Example content is specified. | ***Content Indifferent*** | Content is expected to be present in the message, but not a specific value. | 1. The presence of content is being assessed by the validation tool. 2. Specific content is not being assessed by the validation tool.   Additional Assertions Made:  R 🡪 None  RE 🡪 Validates for the presence of data. | R – Required Elements: Indicates the characteristic of the test data given and expected in the vendor message.  RE – Required, but may be Empty Elements: Provides data to be used in the test case to test that the vendor product supports the element. Indicates the characteristic of the test data given and expected in the vendor message.  The characteristic type of the data is further described by the qualifier. |
| ***Configuration*** | Content is expected to be present in the message, but not a specific value. The value is usually determined at installations. |
| ***System Generated*** | Content is expected to be present in the message, but not a specific value. The value is system generated. |
| ***Test Case Proper*** | Content is expected to be present in the message, but not a specific value. However, content is expected to be consistent with the clinical test story. |
| **Presence-Length** | Example content is specified to a minimum length. | ***Same qualifiers as for Presence*** | Content of a minimum length is expected to be present in the message, but not a specific value. | 1. The presence of content is being assessed by the validation tool. 2. The length of the content is being assessed by the validation tool. 3. Specific content is not being assessed by the validation tool.   Additional Assertions Made:  R 🡪 Validates the length of the data for a minimum value  RE 🡪 Validates for the presence of data and the length of the data for a minimum value | Example data is provided for the test case, specific content is not of interest, but the minimum length of the content is.  Example use: Test that the vendor supports PID-5.3 (Second and Further Given Names or Initials Thereof) element to a certain length. Some vendors support only the middle initial.  The qualifiers indicate for the Presence test data category applies to the Presence-Length test data category. |
| **Value** | Specific content is specified. | ***Profile Fixed*** | Content is defined as a constant in the conformance profile. The constant is specified in the test data. | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the conformance profile.   Additional Assertions Made:  R 🡪 None  RE 🡪 Validates for the presence of data. | The value is defined as a constant in the conformance profile. That constant is provided as the test data. The validation of the content is accounted for in the profile constraints; no additional assertion is needed for Required elements. For RE elements, a presence check is required. A typical use is when the constant is required when an RE element is predicated on being present. |
| ***Profile Fixed - List*** | Content is defined as a set of allowable values in the conformance profile. One value from the allowable set is specified in the test data. | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the conformance profile.   Additional Assertions Made:  R 🡪 None  RE 🡪 Validates for the presence of data. | The value is defined as a set of allowable values in the conformance profile. One value in this set is provided as the test data. The validation of the content is accounted for in the profile constraints; no additional assertion is needed for Required elements. For RE elements, a presence check is required. A typical use is when the constant is required when an RE element is predicated on being present. |
| ***Test Case Fixed*** | Content that is defined as a constant in the test case. | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the test case.   Additional Assertions Made:  R 🡪 Validates for specific content  RE 🡪 Validates for the presence and data specific content | A specific value for this data element is specified in the test case and that specific value is expected in the message. The test case developer is requesting a specific value to assess support for a certain value that is in scope of the defined requirements (e.g., a specific coded value), to trigger a certain workflow or function, or to ensure the coordination of subsequent test steps in a test case. |
| ***Test Case Fixed - List*** | Content is defined as a set of allowable values in the test case. One value from the allowable set is specified in the test data. | 1. The presence of content is being assessed by the validation tool. 2. Specific content is being assessed by the validation tool as specified in the test case.   Additional Assertions Made:  R 🡪 Validates for specific content  RE 🡪 Validates for the presence and data specific content | A specific value from a set of values for this data element is specified in the test case and one of the values from that set is expected in the message (not necessarily the specific value given in the test data). The test case developer is requesting one value from a set of values to assess support for a certain set of values that is in scope of the defined requirements (e.g., a coded value defining a concept), to trigger a certain workflow or function, or to ensure the coordination of subsequent test steps in a test case. |
| **Non-presence** | No content is explicitly specified. | ***None*** | None | 1. The non-presence of content is being assessed by the validation tool.   Additional Assertions Made:  R 🡪 N/A  RE 🡪 Validates for the non-presence of data | Content is not specified in the test case and is not expected to be present in the message. Typically will applies to data elements with RE usage in which the test case developer wishes to ensure that the implementation doesn’t provide a default value when no data is available. |

TCAMT Implementation

Implement in TCAMT for the dropdown and subsequently in the Message Content:

**Indifferent**

**Presence**-Content Indifferent

**Presence**-Configuration

**Presence**-System Generated

**Presence**-Test Case Proper

**Presence Length**-Content Indifferent

**Presence Length**-Configuration

**Presence Length**-System Generated

Etc.

The constraints that need to be generated are specified in TABLE 2 and TABLE 3. We discuss how to handle the lists.

**TABLE 3**

**Test Case Categories: Working Document and Specification**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **R. Snelick 09/25/2015 Draft 4** | | | | | |
| **Test Data Categorization** | **Description** | **Source of Requirement** | **Example** | **Validation Context Assertion** | **Comments** |
| **No Data Element Validation** | | | | | |
| **Indifferent** | Data is not provided as part of the test case and there is no expectation of data but data is permitted. No example data is provided. | N/A | 1. Any element that is RE 2. HD   E1 – C(R/X)  E2 – C(R/X)  E3 – C(R/X)  E1 🡪 conindiff  E2 🡪 indiff  E3 🡪 indiff | None | Data is not provided as part of the test case. No assessment of the data element is made. Usually applies to elements with RE usage in which valuing the element or not is not relevant to the test case. Another case in conditionals where either (option, the T/F) may be valued (e.g., HD data type; we maybe want to check support for one or the other condition option, therefore we make one content indifferent and the other indifferent. |
| **Non-content Data Element Validation – Presence Check** | | | | | |
| **Content Indifferent** | Data where the specific content is not relevant for the Test Case but is expected to be valued; data can be changed. Example data is provided. | Conformance Profile | OBX.23 – Performing Organization Name[[3]](#footnote-3) | R🡪 no action  RE 🡪 generates a presence check | Data that if changed doesn’t alter the interpretation or execution of the test case operation. |
| **Configurable** | Data that is typically configured by the system (customer-definable). Example data is provided. | Conformance Profile | MSH.3 – Sending Application | R 🡪 no action  RE 🡪 generates a presence check | Data that is determined at installation and is site dependent. |
| **System Generated** | Data typically generated automatically by the system, e.g., time of message. Example data is provided. | Conformance Profile | MSH.7 – Date/time of Message  Other example may include generation of identifiers. | R 🡪 no action  RE 🡪 generates a presence check | Data that is dynamically generated by the system. In some cases it is runtime dependent.  Normally, the IG should indicate that the element is system generated (other content indifferent is more appropriate, say, e.g., for a patient identifier). See Craig’s notes, may have to go back to what I had before. |
| **Test Case Proper** | Data that is consistent with the clinical backdrop of the test story. The data value might have to be coordinated to conduct test. Data can change with pre-caution. Example data provided. | Conformance Profile | OBX.8 – Abnormal Flags; The combination of OBX.5 (Observation Value) and OBX.7 (Reference Range) indicates an abnormal flag of H – High.  CVX code and date given.  CWE.2 and CE.2 – Text needs to be appropriate for code. | R 🡪 no action  RE 🡪 generates a presence check | Data content that is significant to ensure soundness of the test case from a real world perspective or to enact operation of the test case. Data can be changed but with consideration. Data is important to demonstrate use/relationships of data elements. The indicator is informational in nature, but if not followed some systems may not be able to perform the test case because they ensure data quality. That is, their system may prevent the system from creating a message because the data is not sound.  For coded elements, visual inspections can be made if desired. |
| **~~Profile Fixed - Presence~~** | ~~A secondary requirement is specified in the Profile but is dependent on the presence of the element first.~~ | ~~Conformance Profile~~ | ~~RE element, that if, valued is constrained to a fixed or set of fixed values.~~ | ~~R 🡪 no action~~  ~~RE 🡪 generates a presence check~~ | ~~Statement might be “If valued, OBX-43 (Some Element) SHALL be valued with ‘123’.” The categorization is needed to trigger a presence check even if the content is validated with assertions in the conformance statement.~~  Don’t need covered by Profile-fixed and PF –list; just need to at presence check for RE for these. |
| **Non-Content Data Element Validation – Check for Non-Presence** | | | | | |
| **Not-Valued** | No data is expected based on the test story and functional requirements. Typically will apply to elements with RE usage[[4]](#footnote-4). | Test Case | Any case where we want to ensure an element is not-valued. | R 🡪 N/A  RE 🡪 generates a not-valued presence check | Typically will apply to elements with RE usage (which likely could have been specified as conditional elements). Functional requirements outside the scope of interoperability (content) specification might indicate improper use of the element or to detect systems that incorrectly provide default values. |
| **Content Data Element Validation – Presence and Value Check** | | | | | |
| **Profile Fixed** | Data that is fixed by the conformance profile; data can’t be changed. Specific data is provided. | Conformance Profile | PID.1 – Set ID | R🡪 no action  ~~RE🡪no action~~  RE 🡪 generate a presence check | Likely to originate from a conformance statement (either explicit or implied in the text/comments). The categorization helps identify the origin of the requirement. Example conformance statement might be: “PID.1 (Set ID - PID) SHALL be valued with the constant value '1'.”. |
| **Profile Fixed - List** | Data that is fixed as defined by a set of allowable values by the conformance profile; data can be a valued within the defined set. Specific data is provided. | Conformance Profile | MSH.21 – Message Profile Identifier  **LRI-37:** If valued, OBR-11 (Specimen Action Code) **SHALL** be a value with “A”, “G”, “L”, or “O”. | ~~No Action~~  R 🡪 No Action  RE 🡪 generate a presence check | Data is often a coded value and is constrained by a value set. One data value in the defined list is expected to be present.  Might be the case where the list is a subset of a value set (this is a case where the value set is not defined at the necessary granularity/preciseness). |
| **Test Case Fixed** | Data that is specific and fixed by the Test Case; data can’t be changed. Specific data is provided. | Test Case | (E.g., OBR-25 – Result Status) | R🡪 generates a constant value check  RE🡪 generates a presence check and constant value check | Data deemed by the test case developer to be specific data based on the clinical test story. Exact content of data is validated.  Also, important for Query messages or any test step that involves other steps that relies on certain data values. For example, querying an IIS for immunization for a certain patient. For the query message we would want to make the patient demographic data test case fixed. |
| **Test Case Fixed - List** | Data that is fixed as defined by a set of allowable values by the test case developer; data can be a value within the defined set. Specific data is provided. | Test Case | OBX.3.1 – Observation Identifier; 1 of N valid LONIC codes for Hemoglobin. | R🡪 generates a constant value check from a list provided  RE🡪 generates a presence check and constant value check from a list provided | This is the case where we want to check for specific content, but depending on the implementation more than one value is acceptable (and no other requirement is specified that binds it to a constant). The test case developer provides a list of acceptable values. The example data picks one from that list and the validation accepts any from that list. This is applicable to inspection tests; |
| **Content Data Element Validation – Presence and Generic Content Check** | | | | | |
| **Test Case Fixed – ~~Minimum~~ Length**  **(Can really handle maximum to)** | Data in which the minimum length (size) of the data is specified by the Test Case; the length of the data has to be at minimum the length indicated. | Test Case | PID-5.3 – Middle Name  NTE-3 Comment | R🡪 generates a constraint check for the length of the value  RE🡪 generates a presence check and a constraint check for the length of the value | This covers the cases where we are indifferent to the content but want to test for support to a certain length. For example, some system only support a middle initial (this indicator could test support for a certain minimum length). Another example includes the length of comment notes.  For 5..10, Maximum can be handle by just providing data with length 10. This is not meant for Errors—that will be dealt with separately. |
| **~~Test Case Fixed – Exact Length~~** | ~~Data in which the length (size) of the data is fixed by the Test Case; the length of the data can’t be changed.~~ | ~~Test Case~~ | ~~NTE-3 - Comment~~ |  | This case is too much of an outlier and I can’t think of a case where another category wouldn’t cover it. |
| **Implant Data In Error** | | | | | |
| **Error – Non Supported Element** | Indicates that the test data is in error with respect to the profile requirements. | Test Case | Any X element where we add data. | Nothing | Mostly used for messages that are intended to be received. |
| **Error -** |  |  |  |  | TODO: We can come up with a long list of more implanted errors. |

Categories are intended provide additional information about the test case to help understanding of the example message and to indicate what the validation is assessing. The data categorization is supplemental (additional) information to implementation guide; e.g., a requirement for a data element already addressed by a conformance statement in the conformance profile is not intended to be duplicated by the data categorizations. For example, there is no need for us to add a present check for an “R” element.

Note: Parent’s up in the hierarchy will also need to add presence checks where necessary. For example (F1 = RE, C1= RE; when C1 is assigned content-indifferent than C1 will have a presence check and so will F1). Same with (F1 = RE, C1 = R), etc.

**How to handle Conditions:**

There is nothing special to do for conditions with respect to the data categorization. The test case developer manages the data that triggers a condition to fire. Once the conditional element is “in play” then it is treated just like an “R”, “RE”, or “X” usage is treated.

Example 1:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | Usage | Card | DT | Len | VS | Predicate | Data | Category |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.6 : Administered Amount | R | [1,1] | NM | [1,20] |  |  | 999 | Test Case Fixed |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/field.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7 : Administered Units | C(R/O) | [0,1] | CE\_IZ | [1,483] | UCUM | If Administered Amount is not valued "999" |  | Not-valued |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.1 : Identifier | R | [1,1] | ST | [1,50] |  |  |  | Implied Not-valued |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.2 : Text | RE | [1,1] | ST | [1,999] |  |  |  | Implied Not-valued |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.3 : Name of Coding System | R | [1,1] | ID | [1,20] | 0396 |  |  | Implied Not-valued |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.4 : Alternate Identifier | RE | [1,1] | ST | [1,50] |  |  |  | Implied Not-valued |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.5 : Alternate Text | RE | [1,1] | ST | [1,999] |  |  |  | Implied Not-valued |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.6 : Name of Alternate Coding System | C(R/X) | [1,1] | ID | [1,20] | 0396 | If CE.4 (Alternate Identifier) is valued. |  | Implied Not-valued |

Example 2:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | Usage | Card | DT | Len | VS | Predicate | Data | Category |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.6 : Administered Amount | R | [1,1] | NM | [1,20] |  |  | 15 | Test Case Fixed |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/field.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7 : Administered Units | C(R/O) | [0,1] | CE\_IZ | [1,483] | UCUM | If Administered Amount is not valued "999" |  |  |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.1 : Identifier | R | [1,1] | ST | [1,50] |  | ml |  | Test Case Fixed |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.2 : Text | RE | [1,1] | ST | [1,999] |  | milliliter |  | Test Case Proper |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.3 : Name of Coding System | R | [1,1] | ID | [1,20] | 0396 | UCUM |  | Test Case Fixed |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.4 : Alternate Identifier | RE | [1,1] | ST | [1,50] |  |  |  | Indifferent |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.5 : Alternate Text | RE | [1,1] | ST | [1,999] |  |  |  | Indifferent |
| http://hl7v2-iz-testing.nist.gov/mu-immunization/resources/core-images/component.pnghttp://hl7v2-iz-testing.nist.gov/mu-immunization/faces/javax.faces.resource/spacer/dot_clear.gif?ln=primefaces&v=3.5RXA.7.6 : Name of Alternate Coding System | C(R/X) | [1,1] | ID | [1,20] | 0396 | If CE.4 (Alternate Identifier) is valued. |  | Indifferent |

**Specification for Injecting Error Conditions:**

Error – Not-supported element present

Error-Required Element Missing

Error-Maximum Length Exceeded

**Description of Error Message for Test Case Constraints**

|  |  |  |
| --- | --- | --- |
| **Test Data Category** | **Error Description** | **Example** |
| Parent-Presence | Expected content is missing. A decedent of $location ($element\_name) is expected to be present. | TCA-001: Expected content is missing. A decedent of PID-6(Mother’s Maiden Name) is expected to be present. |
| Indifferent | N/A – no constraint is generated. |  |
| Presence\_ContentIndifferent | Expected content is missing. The empty value at $location ($element\_name) is expected to be present. | TCA-001: Expected content is missing. The empty value at ORC-12.3(Given Name) is expected to be present. |
| Presence\_Configuration | Expected content is missing. The empty value at $location ($element\_name) is expected to be present. | TCA-003: Expected content is missing. The empty value at MSH-3.1 (Namespace ID) is expected to be present. |
| Presence\_SystemGenerated | Expected content is missing. The empty value at $location ($element\_name) is expected to be present. | TCA-004: Expected content is missing. The empty value at ORC-12.1 (ID Number) is expected to be present.  This is probably not the best example, but the best I could find for now. It really doesn’t matter since the error messages are all the same for these. |
| Presence\_TestCaseProper | Expected content is missing. The empty value at $location ($element\_name) is expected to be present. | TCA-005: Expected content is missing. The empty value at RXA-5.2 (Text) is expected to be present. |
| PresenceLength\_ContentIndifferent | Expected content is missing or content does not meet the minimum length requirement. The $value at $location ($element\_name) is expected to be present and be at minimum $length characters.  Note: Substitute “empty value” for $value if $value is missing. | TCA-006: Expected content is missing or content does not meet the minimum length requirement. The empty value or value at PID-5.3 (Second and Further Given Names or Initials Thereof) is expected to be present and be at minimum 8 characters. |
| PresenceLength\_Configuration | Same as PresenceLength\_ContentIndifferent | Probably won’t use. |
| PresenceLength\_SystemGenerated | Same as PresenceLength\_ContentIndifferent | Probably won’t use. |
| PresenceLength\_TestCaseProper | Same as PresenceLength\_ContentIndifferent | Probably won’t use. |
| Value\_ProfileFixed | Expected profile fixed content is missing. The $value at $location ($element\_name) does not match the expected value $expected\_value.  Change To:  Invalid content (based on profile fixed data). The $value at $location ($element\_name) does not match the expected value $expected\_value.  Note: Substitute “empty value” for $value if $value is missing. | I’ll add later… |
| Value\_ProfileFixedList | Expected profile fixed content is missing. The $value at $location ($element\_name) does not match one of the expected values $expected\_value\_list.  Change To:  Invalid content (based on profile fixed data). The $value at $location ($element\_name) does not match the expected value $expected\_value.  Note: Substitute “empty value” for $value if $value is missing. | I’ll add later… |
| Value\_TestCaseFixed | Expected test case fixed content is missing. The $value at $location ($element\_name) does not match the expected value $expected\_value.  Change To:  Invalid content (based on test case fixed data). The $value at $location ($element\_name) does not match the expected value $expected\_value.  Note: Substitute “empty value” for $value if $value is missing. | I’ll add later… |
| Value\_TestCaseFixedList | Expected test case fixed content is missing. The $value at $location ($element\_name) does not match one of the expected values $expected\_value\_list.  Change To:  Invalid content (based on test case fixed data). The $value at $location ($element\_name) does not match the expected value $expected\_value.  Note: Substitute “empty value” for $value if $value is missing. | I’ll add later… |
| NonPresence | Unexpected content found. The $value at $location ($element\_name) is not expected to be valued for test case. | I’ll add example later… |

1. The example used is for HL7 v2.x. For brevity, “Middle Name” is used instead of the actual element name (Second and Further Given Names or Initials Thereof). [↑](#footnote-ref-1)
2. Element is RXA-5 (Administered Code—in this case an immunization) [↑](#footnote-ref-2)
3. Assuming for the given test case this exact content of this element is not relevant. [↑](#footnote-ref-3)
4. Conditionals will resolve to R, RE, O, or X so we don’t envision this category applicable for these cases. [↑](#footnote-ref-4)