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Introduction

The CPM ESI server (CPM_SrvESI.exe) accepts discrete microbiology results. These results are sent in a Health Level 7 (HL7) standard ORU message. The purpose of this document is to define how ESI processes these messages, where and how they are posted in the database, as well as provide installation requirements and troubleshooting hints.

The Message

It is necessary to make certain assumptions about the message being sent from the external system. These assumptions center on identifying a message as a microbiology message, distinguishing between organism and susceptibility results, and fields that are either required by HL7 or are needed by ESI to successfully process the message.

Identifying a Microbiology Message

A microbiology result that is sent from an external system has the same structure as any other result being sent in an ORU message. It is therefore necessary to determine the type of result based on the content of the message. This is accomplished by examining the contents of the Diagnostic Service Section field (OBR-24). If this field is valued to MB or MA, or if this field contains an alias to the Microbiology event class code, CDF meaning MBO on Code Set 53, ESI treats the message as a microbiology result.

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Cultures, Organisms, and Susceptibilities

A Discrete Microbiology result consists of three parts: 1) the culture, 2) organisms, and 3) susceptibilities. Each of these sections is explained below along with the ORU message components that differentiate them.

Cultures

The culture is sample of organic matter (for example, sputum or wound) taken from a patient. This culture is then incubated in order to promote the growth of organisms within the culture. Microbiology results can be viewed as a hierarchy with the culture as the root or base.

A Culture OBR not only contains information about the culture, but also contains information about the reports created about the culture, and information about the various organisms growing in the culture. A Culture OBR is identified as such by establishing that the ORU message represents a microbiology result as explained above, and that the OBR does not represent a susceptibility (explained below). The requirements for this section of the OBR are the same as the requirements for a General Lab result.

The reports associated with the culture is contained in child OBX segments. The reports are identified by having an Observation ID (OBX-3.1) not equal to ORGANISM. Beyond this requirement, they are treated just as any other document would be.

Culture Statuses

It is appropriate to associate a status, usually positive or negative, with the culture. This indicates whether or not an organism has been identified.

The CPM ESI servers mechanism for identifying this status is a culture status OBX. The CPM ESI Server identifies a culture status OBX as follows. It has its Observation ID (OBX-3.1) aliased to a code value on Code Set 18089 with a CDF meaning of CULTSTAT. When a culture status OBX is identified, ESI looks first in OBX-5 Observation Value for a string. If nothing is found in OBX-5, ESI looks in OBX-8 Abnormal Flag. The value found is used as an alias to Code Set 52 to populate the NORMALCY_CODE field on the Culture clinical event (see the Clinical Event Representation of Microbiology Results).

Report-Level Comments

Comments related to the microbiology result in general can be stored at the culture report level. One or more NTE segments following the culture OBR are used to create such a comment. This is a CE_EVENT_NOTE attached to the Culture Clinical Event. The note type defaults to order comment, although any note type can be specified. See the Universal Interface Specifications Results Inbound for details on the NTE segment.

Organisms

An organism, or isolate, is a single bacterial entity growing within the culture. Once the organism has been identified, tests can be run on it to determine what kills it. Organism information can be sent either as an OBX on a culture message, or as part of the OBR on a susceptibility message.

If the organisms are sent as OBX segments attached to a Culture OBR, multiple organisms can be sent in a single ORU message. It is required that each Organism OBX have its Observation Id (OBX-3.1) set to the literal ORGANISM. If this field is not set to the literal, it is treated as a culture report. Also, the Observation Value field needs to be set to the name of the organism. An additional requirement is that the Observation Sub Id field of the OBX be incremented for each additional organism. This field is used to identify the specific organism in subsequent updates.

The requirements for organisms specified in a Susceptibility OBR are defined in the Susceptibility section.

Susceptibilities

A susceptibility is measurement of whether an antibiotic effectively kills an organism. A given organism is normally interpreted as either susceptible or resistant to an antibiotic. This is known as an Interpretation result. Additionally, a susceptibility can also have a numeric result associated with the interpretation. This is referred to as the Numeric result. Susceptibilities are represented in the OBX segments attached to a Susceptibility OBR.

A Susceptibility OBR is defined as follows:

1. It is a microbiology result. This is determined in the same manner as it is for Culture OBRs.
2. The Universal Service ID (OBR-4.1) is an alias to a Susceptibility Type (Code Set 65). This code set is not added to on the fly, so if it is not found, the OBR is considered to represent a culture.
3. The Parent Observation Id (OBR-26.1.1) must be filled out.

The Parent Observation Id is assumed to be the same as the Universal Service Id of the Culture OBR. Additionally, either the Parent Filler Id (OBR-29.2.1) and the Parent Filler App Id (OBR-29.2.2), or the Filler Order Number Id (OBR-3.1) and the Filler Order Number App Id (OBR-3.2) must be filled out. The parent fields are checked first. If they are not valued, the Filler Order Number fields are used. Whichever set of fields ends up being used, they need to be the same as the Filler Order Number fields in the Culture OBR.

These three fields (Parent Filler Id, Parent Filler App ID (or Filler Order Number Id and Filler Order Number App Id), and the Parent Observation Id are concatenated together to create the base reference number. By further adding the character 1 to the base reference number, the reference number for the culture is constructed. Using this number the culture and any associated organisms can be found in the database.

Now that it has been explained how the associated culture is found, it is necessary to explain how the associated organism is found. Organism information can

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be included in the OBR or be attached to the OBR in an OBX segment.

If the organism information is going to be included in the OBR, minimally, its Observation Sub Id must be included in the Parent Result Observation Sub Id (OBR-26.2) field. If the organism was included in the Culture message, this is all that is needed to find the organism; however, if the organism was not included in the Culture message, the Parent Result Observation Result Id must be valued so that the organism can be created in the database.

If the organism information is being sent in an OBX:

- Its Observation Id (OBX-3.1) must be set to the literal ORGANISM. Additionally, it must be the only OBX with this field set to ORGANISM.
- Its Observation Sub Id (OBX-4) must be set.
- The name of the organism should be in the Observation Value (OBX-4) field.

If the organism can be found in the database, it is updated with any changes. If it was not found, it is created.

The susceptibility itself is constructed using the non-organism OBX segments attached to the Susceptibility OBR. Of note here is that the Interpretation result (susceptible, resistant) is taken from the Abnormal Flag (OBX-8) field, while the Numeric result (the numeric result found when applying the antibiotic to the organism) is taken from the Observation Value (OBX-5.1). While neither field is required, it does not make sense to have sent the OBX segment without one or the other. The name of the antibiotic is assumed to be in the Observation ID (OBX-3.1) field.

Suppressing the Charting of Susceptibilities

It is possible to store susceptibility details that are not to be displayed with the result. This is done, for example, when a panel of antibiotics are sent but some on the panel are not actually able to be used.

Suppression of a susceptibility is accomplished as follows: On the OBX for the susceptibility that should not be charted, send a string in OBX-13 User Access Checks. This string should be aliased to the code value on code set 18089 with CDF meaning of NOSUSCHART. If this is sent, the susceptibility is still posted but the chartable flag is turned off.

Susceptibility Footnotes

Susceptibility footnotes provide a mechanism to store information about a specific susceptibility result. A susceptibility footnote is created from an NTE segment that follows a susceptibility detail OBX.

> **Note**
> Susceptibility footnotes are currently available only when using list replace Option 3. See the section for details on list replacement.

Clinical Event Representation of Microbiology Results

The Clinical Event Data Model stores the microbiology results in a hierarchical form which is consistent with the general nature of microbiology results.

Full Size

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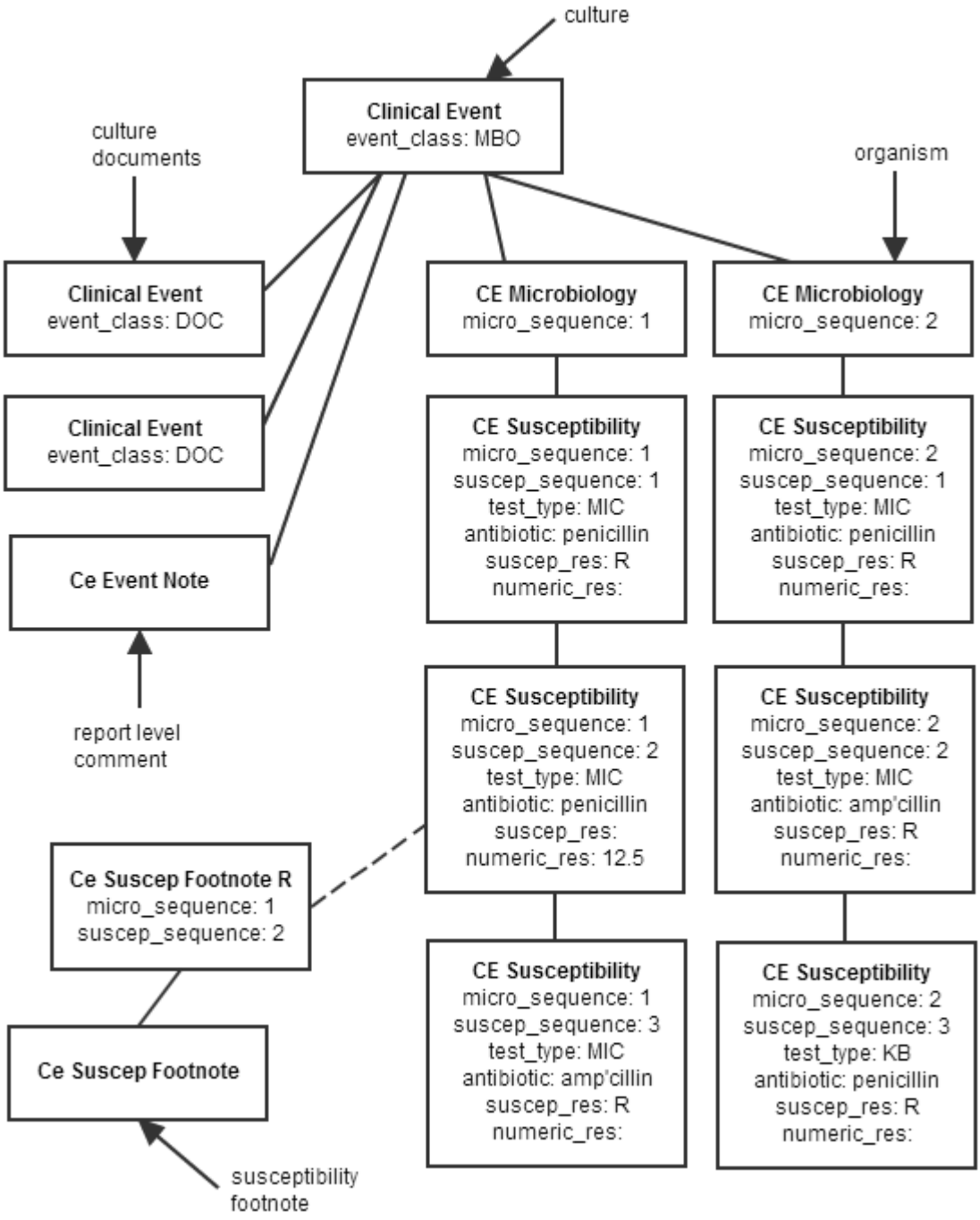

At the root of the hierarchy is the Culture Clinical Event. All organisms, documents and susceptibility are either directly or indirectly parented by this entity. It has an Event Class of MBO. MBO is the CDF Meaning of the code value for Code Set 53 which signifies that the Clinical Event represents a microbiology result.

In the above model, there are two child Clinical Event structures. These are the Culture Report Clinical Events. There can be any number of these reports, only two are shown for simplicity. Each of these Clinical Event structures has sub-structures that contain various information about the documents and the contents of the documents themselves.

Also hanging off the Culture Clinical Event are two CE Microbiology structures. These represent the organisms found in the culture. These are differentiated from each other primarily by the micro sequence number.

Attached to each of the CE Microbiology structure are several CE Susceptibility structures (in this case there are three each, but there are no rules governing a minimum or maximum). Each of these susceptibility structures identify the organism they are associated with by storing the Micro Sequence Number of the organism to which they belong. The susceptibilities are differentiated from each other by Susceptibility Sequence Number, Susceptibility Test Type (for example, MIC (Mean Inhibitory Concentration), KB (Kirby Bauer)), and the Antibiotic Code. Also of note is the fact that the Interpretive and Numeric results are stored in separate instances of the structure. This is because the Microbiology Team is posting Interpretation and Numeric results as separate entries, but they are treating Numeric results as code values. It is neither appropriate nor desirable for ESI to translate numeric data to code values. Therefore, ESI posts separate entries for each, but places the result itself in different fields depending on whether it is an Interpretation (as a code value in the RESULT_CD field) or Numeric result (as a string in the RESULT_TXT_VALUE).

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Installation Requirements

There is certain data that needs to be present for discrete microbiology results to be correctly processed by ESI. These data requirements are in the form of code values with specific CDF Meanings, aliases that are not added on the fly, and code value extensions.

CDF Meanings

There are code values that must exist with certain CDF Meanings. The CDF Meanings themselves should exist in the database, but code values may have to be added by the user. Below is a table of these code values, code sets and CDF Meanings.

Code Set	Code Set Description	CDF Meaning	Description
13	Comment Source	UNKNOWN	Unknown Entry Method
14	Comment Type	ORD COMMENT	Order Comment
14	Comment Type	RES COMMENT	Result Comment
14	Comment Type	UNKNOWN	Unknown Comment Type
21	Event Action	PERFORM	Personnel action of perform
21	Event Action	VERIFY	Personnel action of verify
21	Event Action	AUTHOR	The personnel who authored the text/document
21	Event Action	COMPLETED	The personnel who completed the result
21	Event Action	UNKNOWN	The action the personnel performed is unknown
23	Document Format	AH	ASCII text with hard carriage returns
24	Event Relation	ROOT	Root/Parent Clinical Event
24	Event Relation	CHILD	Child Clinical Event
48	Record Status	ACTIVE	Indicates an active record
53	Event Class	MBO	Microbiology Event
53	Event Class	DOC	Document Event
53	Event Class	GRP	Group Event
53	Event Class	TXT	Text Event
53	Event Class	NUM	Numeric Event
63	Succession Type	UNKNOWN	Unknown succession type
87	Confidence Level	ROUTCLINICAL	Routine Clinical Confidence
120	Compression Type	NOCOMP	No Compression/ not compressed
1004	Detail Susceptibility	GENERICINT	Generic/default interpretation detail susceptibility type
1004	Detail Susceptibility	GENERICNUM	Generic/default numeric detail susceptibility type
1901	Suscep Status	CORRECTED	Corrected Susceptibility
1901	Suscep Status	VERIFIED	Verified Susceptibility
1901	Suscep Status	PERFORMED	Performed Susceptibility
18089	OBX Processing	CULTSTAT	CulturePositive/Negative
18089	OBX Processing	NOSUSCHART	Dont chart susceptibility
18089	OBX Processing	ORGOCCUR	Organism Occurrence

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Aliases

ESI can map values sent from foreign systems to code values within the Cerner data model. Additionally, ESI can add many code values, along with their aliases, as they are sent. This ability is commonly referred to as Add on the Fly (AOF). There are, however, certain code sets to which AOF does not apply. All code values aliased by ESI through the processing of discrete microbiology results are listed in Appendix A.

Code Value Extensions

ESI uses code value extensions to obtain the Detail Susceptibility Tests associated with a certain Susceptibility Test. The Susceptibility Test is resolved using the passed in value as an alias to Code Set 65. If the alias does not exist, it is not created by ESI and is treated as a culture.

There are two extension field names defined for this code set: 1) INTERP and 2) NUMERIC. Both are used to resolve the Detail Susceptibility Test code value in the same manner, the former is for interpretation results while the latter is used for numeric test results.

Once the code value has been resolved for the Susceptibility Test, the CODE_VALUE_EXTENSION table is queried for rows with that code value. A Detail Susceptibility Test code value is resolved, in turn, by querying the CODE_VALUE table for code set 1004 for a row with a DISPLAY_KEY equal to the field value for the code value extension entry.

Note
For processing multiple interp Detail susceptibility Tests, the extension INTERP is not used. See the Multiple Interpretive Detail Processing section for details on setting up multiple interp processing. The extension NUMERIC is used in any case.

Example

A susceptibility message is being sent in specifying a Susceptibility Test of MIC. Additionally, the message has an OBX segment specifying that the organism is susceptible to ampacillin and that the diluent factor was 12.

ESI would query the CODE_VALUE_ALIAS table for code set 65 with an alias of MIC. Lets say that this query returned a code value of 500. Using this code value (500), the CODE_VALUE_EXTENSION table is queried for rows which have their CODE_VALUE equal to 500. Since the OBX has an interpretation result, a row returned from the query of the code value extension table with a FIELD_NAME of INTERP is searched for. If it is found, its FIELD_VALUE field (MICINTERP, for example) is used to query the CODE_VALUE table. Specifically, the CODE_VALUE table is queried for rows which have both a Code Set of 1004 and a DISPLAY_KEY equal to the field value field from the code value extension (for example, MICINTERP). Whatever code value happens to have that display key is used as the Detail Susceptibility Test. If a code value extension row is not found for this type of result, the code value with a CDF Meaning of GENERICINT is used. The processing for numeric results are the same, except for replacing the FIELD_NAME with NUMERIC rather than INTERP and defaulting to a code value with a CDF Meaning of GENERICNUM.

Note
The functionality described in the following two sections, List Replace Option for Microbiology and Susceptibility rows and Multiple Interpretive Detail Processing, are exclusive options. That is, it is not currently possible to set up a feed to do both options at once. The plan for future functionality is to allow both options.

List Replace Option for Microbiology and Susceptibility Rows

List replace functionality gives the ability to replace the CE_MICROBIOLOGY (organism) and CE_SUSCEPTIBILITY rows with a new set sent in as an update, rather than simply updating the existing rows. This is necessary if it is desired to remove a susceptibility result or organism. Note that the sending system must be able to send all unchanged pieces as well since the existing rows are deleted. This section describes the steps to set up this functionality and the options for how much is replaced.

Setup

This option is set at the contributor system level using the ESI Configuration Tool (ESIConfigTool.exe). Currently, the tool does not have the necessary functionality, so it is necessary to use an update statement in Discern Explorer (CCL) to set the desired value on the CONTRIBUTOR_SYSTEM table. The statement is similar to the following:

```
update into contributor_system set micro_list_replace_flag =
where contributor_system_cd =go
```


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The contributor system code can be determined using the ESI_CONFIG_AUDIT program to display the contributor system information. Check to ensure that only the desired row was changed and then perform a commit go. The value of <setting> in the Discern Explorer (CCL) statement varies depending on the specific replace option to be used.

Replace Options

There are four replace options:

Option 0, that is, <setting> = 0 in the Discern Explorer (CCL) statement, is the default processing which does not replace any rows. This updates only existing rows with changed results or adds new rows.

Option 1 causes ESI to replace all CE_SUSCEPTIBILITY rows that have the same organism and susceptibility test type as the message being processed. For example, if a culture has organisms of E. Coli and Staph and the message is sending Kirby Bauer susceptibility results for Staph, all previous Kirby Bauer susceptibility results for the Staph organism are deleted and replaced by the results in the message. Any results for the E. Coli, or for other test methods on the Staph are not affected. Obviously this means that the sending system must then send all desired results, including those that have not changed, for Staph and Kirby Bauer method if one needs to be updated.

Option 2 causes ESI to replace all CE_SUSCEPTIBILITY rows that have the same organism, regardless of susceptibility test type. From the example, if the Staph had both MIC and Kirby Bauer results, option 2 deletes all susceptibility results for the Staph organism and replaces them with the results in the message. So the sending system in this case must resend in the same message all results related to the Staph organism including all susceptibilities for both the MIC and Kirby Bauer methods.

Option 3 causes ESI to replace all CE_MICROBIOLOGY rows and all CE_SUSCEPTIBILITY rows for a culture. For the example, all CE_MICROBIOLOGY rows and all CE_SUSCEPTIBILITY rows are deleted and replaced with the results on the message. This means that the sending system must be able to resend all of the organism information and all of the susceptibility results for each organism. The format to send all of this information in one message is somewhat unique, so an example has been provided in Appendix B.

Multiple Interpretive Detail Processing

If the Susceptibility Tests being used can have multiple interpretive results, follow this section to set up the database for processing. The CPM ESI server still uses OBX-8 Abnormal Flag to determine the result. This section describes how to set up the database and the message to tell the CPM ESI server which Susceptibility Detail Test to use for a given result.

The first step is to indicate that the feed is processing multiple interpretations.

Until this tool is updated with the flag, it is necessary to use an update statement in Discern Explorer (CCL) to set the appropriate value on the CONTRIBUTOR_SYSTEM table. The statement is similar to the following:

```
update into contributor_system set micro_multi_interp_ind = 1 where
contributor_system_cd =go
```

The contributor system code value can be determined using the ESI_CONFIG_AUDIT program to display the CONTRIBUTOR_SYSTEM information. After ensuring that only the desired row was updated, enter commit go to commit the change.

The second step is to create an interp detail (Code Set 1004) for every interp result that can be sent. For example, if a given method can have results of BLOOD, BLOOD:IV, and BLOOD:IM, each one of these must be a separate code value on Code Set 1004.

The last step is to create the aliases that are sent in OBX-8. Unlike single interps, where the alias only indicates the value of the interp result, for multiple interp processing the alias is used to indicate which Detail Susceptibility test to use and the value of the interp result. The aliases sent point to Code Set 1004. For each Susceptibility Detail identified in step two, there must be an alias that includes each possible interp result that can be sent for that Detail. For example, for the Susceptibility Result, BLOOD, if a possible interp value is Susceptible, there must be an alias of BLOOD:S or something similar to differentiate that result from a value of Resistant, BLOOD:R. In addition, each alias must have an alias type meaning that is itself an alias to the interp result value Code Set 64. So continuing the example, if the interp result of Susceptible has an alias of S the alias row BLOOD:S would have an alias type meaning of S. For an interp result of Resistant with an alias of R, the alias row BLOOD:R would have an alias type meaning of R.

Then to send a group of results for BLOOD the message should have either separate OBX segments each with one of the aliases built above in OBX:8, or a single OBX segment with each alias in a repeating field on OBX:8. Note that when sending an update to an existing result, it is necessary to send all Susceptibility Details associated with the Susceptibility test for the organism and antibiotic in question. For example, if Susceptibilities of BLOOD:Resistant and URINE:Sensitive have been sent for a Susceptibility test of KB for the antibiotic Amikacin on an organism of Staph, to change the result from BLOOD:Resistant to BLOOD:Susceptible, the sending system must send URINE:Sensitive again as well, or that detail is removed from the list of results. Any other Susceptibility method, organism and antibiotic combinations are unaffected.

See Appendix C for examples of OBX segments for multiple interp processing.

Processing

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This section contains an overview of the processing ESI performs on the discrete microbiology result messages. It is broken down by message type and by the clinical event table being built.

Culture Message

A culture message is characterized by having the culture specified in the OBR. It is identified as a culture by failing to identify it as a susceptibility message. Additionally, it has OBX segments which represent the various documents, or parts of documents, written about the culture and optionally, organisms growing within the culture.

This type of message produces information to create the parent CLINICAL_EVENT entry, *x* child CLINICAL_EVENT entries, *y* CE_MICROBIOLOGY entries, CE_EVENT_PRSNL entries, and a CE_SPECIMEN_COLL entry: where *x* is the number of document OBX segments and *y* is the number of organism OBX segments.

Parent Clinical Event

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
clinical_event_id						Sequence number-system generated.
event_id						Sequence number-system generated.
valid_until_dt_tm					12/31/1200 00:00:00	Maximum date.
view_level					1	Hard-coded.
order_id						Not used.
person_id					person_id from ADT processing	
encntr_id					encntr_id from ADT processing	
accession_nbr					OBR:FillerField2	
contributor_system_cd	89	Y	N			Resolved through general ESI processing.
reference_nbr					OBR:FillerOrderId + OBR:FillerOrderAppId + OBR:UniversalServiceId + view_level	This field, minus the view_level, comprises the base reference number.
parent_event_id					event_id	It is a root event, so the parent_event_id and event_id are equal.
event_reltn_cd	24	N	N	ROOT		Hard-coded.
valid_from_dt_tm					Today	Hard-coded to current date/time.
event_class_cd	53	N	N	MBO		Hard-coded.
event_cd	72	Y	Y		OBR:UniversalServiceId	
event_tag					OBR:UniversalServiceText	Defaults to OBR:UniversalServiceId.
result_val						Not used.
result_units_cd						Not used.
result_time_units_cd						Not used.
event_start_dt_tm					OBR:ObservationDateTime	Defaults to OBR:ObservationEndDateTime.
event_end_dt_tm					OBR:ObservationEndDateTime	Defaults to OBR:ObservationDateTime.

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event_end_dt_tm_os						Not used.
catalog_dept_cd						Not used.
catalog_type_cd						Not used.
catalog_cd						Not used.
series_ref_nbr						Not used.
task_assay_cd						Not used.
record_status_cd	48	N	N	ACTIVE		
result_status_cd	8	Y	N	ACTIVE, ANTICIPATED, AUTH, CANCELLED, IN ERROR, IN LAB, IN PROGRESS, MODIFIED, NOT DONE, SUPERCEDED, TRANSCRIBED, UNAUTH, UNKNOWN	OBR:ResultStatus	Defaults to first ORC segment with its OrderStatus field filled out. If none of these fields are found, terminate processing of this message and post an error.
authentic_flag					1	Hard-coded.
publish_flag					1	Hard-coded.
qc_review_cd						Not used.
normalcy_cd						Not used.
normalcy_method_cd						Not used.
inquire_security_cd	87	N	N	ROUTCLINICAL		Hard-coded.
resource_group_cd						Not used.
resource_cd						Not used.
verified_dt_tm						Denormalized from ce_event_prsnl row with action of VERIFY.
verified_prsnl_id						Denormalized from ce_event_prsnl row with action of VERIFY.
performed_dt_tm						Denormalized from ce_event_prsnl row with action of PERFORMED.
performed_prsnl_id						Denormalized from ce_event_prsnl row with action of PERFORMED.
normal_high						Not used.
normal_low						Not used.
critical_high						Not used.
critical_low						Not used.
expiration_dt_tm						Not used.
subtable_bit_map					logical *or* of subtables pre-assigned hex value	

CE Event Personnel

There can be any number of personnel associated with the parent/root clinical event.

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
ce_event_prsnl_id						Sequence - system generated.
event_prsnl_id						Sequence - system generated.

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valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
person_id					ClinicalEvent---person_id	
valid_from_dt_tm					today	Current date/time.
action_type_cd	21	N	N	VERIFY, PERFORM, MODIFY, TRANSCRIBE, SIGN, COSIGN	Under modification	
request_dt_tm						Not used.
request_prsnl_id						Not used.
request_prsnl_ft						Not used.
request_comment						Not used.
action_dt_tm					Under modification	
action_prsnl_id					person_id of person found through person management processing of the aliases	Is blank in situations in which we are no ensuring personnel; use the action_prsnl_ft (free-text personnel).
action_prsnl_ft					free-text identifier of personnel	Used when action_prsnl_id cannot be found.
proxy_prsnl_id						Not used.
proxy_prsnl_ft						Not used.
action_status_cd	103					Not used.
action_comment						Not used.
change_since_action_flag						Not used.

CE Specimen Collect

This table contains information about the specimen. It is not built unless the one of the following fields is valued:

1. SpecimentSource - SpecimenNameCode --Identifier (OBR-15.1.1)
2. SpecimenSource - SpecimenNameCode – text (OBR-15.1.2)
3. SpecimenSource - CollectionMethod (OBR-15.3)

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
valid_from_dt_tm					today	Current date.
specimen_id						Not used.
container_id						Not used.
container_type_cd	2051	Y	Y		OBR:SpecSource---Additives	
specimen_status_cd	61					Not used.
collect_dt_tm					Under modification	
collect_method_cd	2053	Y	N		OBR:SpecSource---CollectionMethod	
collect_loc_cd	220					Not used.
collect_prsnl_id					OBR:CollectorId	Defaults to the prsnl_id of the contributor system.
collect_volume					OBR:CollectVolume---Quantity	
collect_unit_cd	54	Y	Y		OBR:CollectVolume---Unit	
collect_priority_cd	2054	Y	Y		OBR:Priority	

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source_type_cd	60 & 2052	Y	N/Y		OBR:SpecimenSouce - SpecimenName - Identifier	Check for an alias on cs60. If it does not exist, check for an alias on cs2052. If alias does not exist on cs2052, add it on cs2052.
source_text					OBR:SpecimenSource - SpecimenName - Text	Defaults to OBR:SpecimenSource - SpecimenName - Identifier.
body_site_cd	60	Y	Y		OBR:SpecimenSource - SpecimenName - Identifier	
danger_cd	59	Y	Y		OBR:DangerCode---Identifier	
positive_ind						Not used.

CE Microbiology

Each organism is stored in a row on the CE_MICROBIOLOGY table.

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
event_id					ClinicalEvent---EventId	
micro_seq_nbr					OBX:ObservationSubId	Should uniquely identify this organism within its associated culture. Its name can change, but this number must always stay the same.
valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
valid_from_dt_tm					today	Current date.
organism_cd	1021	Y	Y		OBX:ObservationValue[1]---Value1	If this field is not valued on the OBX, terminate processing of this message and post an error.
organism_occurrence_nbr					1	Hard-coded.
organism_type_cd	---------					Not used.
observation_prsnl_id						Not used.
biotype						Not used.
positive_ind					1	Hard-coded.
probability						Not used.

Child, Document Clinical Event

If the OBX value type field translates into an event class of TEXT or DOCUMENT, a child document is created.

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
clinical_event_id						Sequence number-system generated.
event_id						Sequence number-system generated.
valid_until_dt_tm					12/31/1200 00:00:00	Maximum date.
view_level					0	Hard-coded.
order_id						Not used.
person_id					from Parent Clinical Event	
encntr_id					from Parent Clinical Event	
accession_nbr						Not used.
contributor_system_cd	89	Y	N			Resolved through general ESI processing.

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reference_nbr					BaseReferenceNbr + OBX:ObservationId---Identifier + OBX:ObservationSubId + ViewLevel	BaseReferenceNbr = OBR:FillerOrderId + OBR:FillerOrderAppId + OBR:UniversalServiceId
parent_event_id					from Parent Clinical Event	Ties this clinical event to the root.
event_reltn_cd	24	N	N	CHILD		Hard-coded.
valid_from_dt_tm					from Parent Clinical Event	
event_class_cd	53	N	N	DOC		Hard-coded.
event_cd	72	Y	Y		OBX:ObservationId---Identifier	
event_tag					OBX:ObservationId---Identifier	
result_val						Not used.
result_units_cd						Not used.
result_time_units_cd						Not used.
event_start_dt_tm					OBX:ObservationDateTime	Defaults to OBR:StatusChangeDateTime. If neither are valued, terminates processing of this message and posts an error message.
event_end_dt_tm					OBX:ObservationDateTime	Defaults to OBR:StatusChangeDateTime. If neither are valued, terminates processing of this message and posts an error message.
event_end_dt_tm_os						Not used.
catalog_dept_cd						Not used.
catalog_type_cd						Not used.
catalog_cd						Not used.
series_ref_nbr						Not used.
task_assay_cd						Not used.
record_status_cd	48	N	N	ACTIVE		
result_status_cd	8	Y	N	ACTIVE, ANTICIPATED, AUTH, CANCELLED, IN ERROR, IN LAB, IN PROGRESS, MODIFIED, NOT DONE, SUPERCEDED, TRANSCRIBED, UNAUTH, UNKNOWN	OBR:ResultStatus	Defaults to Parent Clinical Event.
authentic_flag					1	Hard-coded.
publish_flag					1	Hard-coded.
qc_review_cd						Not used.
normalcy_cd						Not used.
normalcy_method_cd						Not used.
inquire_security_cd	87	N	N	ROUTCLINICAL		Hard-coded.
resource_group_cd						Not used.
resource_cd						Not used.
verified_dt_tm						Denormalized from ce_event_prsnl row with action of VERIFY.

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verified_prsnl_id						Denormalized from ce_event_prsnl row with action of VERIFY.
performed_dt_tm						Denormalized from ce_event_prsnl row with action of PERFORMED.
performed_prsnl_id						Denormalized from ce_event_prsnl row with action of PERFORMED.
normal_high						Not used.
normal_low						Not used.
critical_high						Not used.
critical_low						Not used.
expiration_dt_tm						Not used.
subtable_bit_map					logical *or* of subtables pre-assigned hex value	

CE Event Personnel

This section is similar to the Parent Clinical Events personnel rows.

CE Blob Result

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
event_id					from Parent Clinical Event	
valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
valid_from_dt_tm					today	Current date.
checksum					calculated by event ensure	
succession_type_cd	63	Y	N	ADDENDUM, CUM, CUM AMEND, CUM INT, CUTOFF, FINAL, INTERIM, PERIODIC, PRELIM INT, REPL, SPLIT CUM, UNKNOWN	OBX:ResultStatus	Defaults to a code value with a CDF meaning of UNKNOWN.
sub_series_ref_nbr						Not used.
storage_cd	25	N	N	BLOB		
area_cd						Not used.
format_cd	23	N	N	AH		
blob_handle						Not used.
blob_attributes						Not used.

CE Blob

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
event_id					from Parent Clinical Event	
valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
blob_seq_num					0	Hard-coded.

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valid_from_dt_tm					today	Current date.
blob_length					size, in bytes, of OBX:ObservationValue[1]---Value1	
compression_cd	120	N	N	N	0	Hard-coded.
blob_contents					OBX:ObservationValue[1]---Value1	

Susceptibility Message

A Susceptibility OBR is defined as follows:

1. It is a microbiology result. This is determined in the same manner are it is for Culture OBRs.
2. The Universal Service ID (OBR-4.1) is an alias to a Susceptibility Type (Code Set 65). This code set is not added to on the fly, so if it is not found, the OBR is considered to represent a culture.
3. The Parent Observation ID (OBR-26.1.1) must be filled out.

Once a message has been identified as a susceptibility, the reference number for its parent is reconstructed and used to query the database. From here there are two paths which can be traveled, and the one traveled is determined by the outcome of the query (success = the parent Clinical Event was found, failure = the parent Clinical Event was not found). Both paths are explained after the explanation of the query.

Query for the Parent Clinical Event

The manner in which the query request is valued is listed below.

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
query_mode					QUERY_SINGLE	Restricts the query to only the Clinical Event node specified, children of that node are not returned in the reply.
event_id						Not used.
contributor_system_cd	89				contributor system which was resolved by normal ESI processing	
reference_nbr					OBR:ParentNumber - FillerOrderNumber - Id + OBR:ParentNumber - FillerOrderNumber - AppId + 1(view_level)	If the Parent Order Numbers are not filled out, use the OBR:FillerOrderNumber - Id and OBR:FillerOrderNumber - AppId fields instead.
subtable_bit_map					CE_MICROBIOLOGY	CE_SUSCEPTIBILITY Tells the query to return only CE_MICROBIOLOGY and CE_SUSCEPTIBILITY sub-tables.
valid_from_dt_tm						Not used.
decode_flag						Not used.

Successful Query

By definition, a successful query means the Clinical Event row was found. It, however, does not imply that any microbiology or susceptibility rows were found. On a successful query, the query reply is copied to the Event Ensure request (they have exactly the same structure). The Clinical Event structure found in this query is not changed for the Event Ensure request.

Finding the Organism

The OBR segment is then examined to be determined whether it contains the organism information. The OBR segment is determined to contain organism information if the ParentResult - ObservationResult - Identifier (OBR-26.3.1) and the ParentResult - ObservationSubId (OBR-26.2) are valued. If these fields are not valued, the list of OBX segments attached to the OBR are searched for one which has an ObservationId of ORGANISM. If an Organism OBX is found it is used instead of the fields from the OBR. If the OBR does not have organism information and an Organism OBX cannot be found, processing of this transaction terminates and an error is posted.

In either case, the purpose is to identify the organism sequence number and the organism name. If the organism information is in the OBR, the number comes from the ParentResult - ObservationSubId (OBR-26.2) and the name comes from the ParentResult - ObservationResult - Identifier (OBR-26.3.1), otherwise the number comes from the ObservationSubId from the OBX (OBX:4) and the name comes from the ObservationValue[1] - Value1 (OBX-5.1): Wherever they come

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from, they are referred to as the *Number* and the *Name* from this point forward. The *Number* is used to search through the list of CE Microbiology structures attached to the Clinical Event found in the query. If an attached CE Microbiology structure has a Micro Sequence Number (MICRO_SEQ_NBR) equal to the *Number*, it is kept as part of the Event Ensure request while all the other CE Microbiology structures are removed from the request. The remaining CE Microbiology structure has its Organism Code (ORGANISM_CD, Code Set 1021) updated with the code value found by translating the *Name*. If the appropriate CE Microbiology structure is not found, it is created using either the information from the OBR or the OBX. Please see the field mappings under the section Unsuccessful Query. The rest of this section assumes that the CE Microbiology exists, whether through finding it in the query or creating it from scratch.

Finding the Susceptibilities

Now that the CE Microbiology structure has been found or created, the susceptibilities can be processed. There is one last bit of information needed from the OBR segment which applies to all the OBX segments: this information is the Susceptibility Test Code (Code Set 65). The UniversalServiceId (OBR-4.1) is translated on Code Set 65 to obtain this information (it is already known that the alias exists because the message would not be considered a susceptibility message if it did not see the Susceptibilities section). Using the Susceptibility Test Code, the Detail Susceptibility Test Codes is determined as described in the Code Value Extensions section. The Detail Susceptibility Test Codes are referred to as the Numeric Detail Susceptibility Test and the Interpretive Detail Susceptibility Test. With these code values in hand, processing of the susceptibilities can begin.

It is assumed that all OBX segments attached to the OBR represent a susceptibility, unless the ObservationId (OBX-3.1) is equal to the literal ORGANISM or the literal PREV ORGANISM (some sending systems include the prior name of the organism in a separate OBX segment if the name has changed). For each susceptibility OBX segment, the Antibiotic Code is found. The Antibiotic Code (Code Set 1011) is determined by translating the ObservationId (OBX-3.1) and adding it on the fly if necessary. The OBX is then checked for *Numeric* and *Interpretive* data. The OBX is considered to have *Numeric* data if its ObservationValue[1] - Value1 (OBX-5.1) is filled out. The OBX is considered to have *Interpretive* data if its AbnormalFlag[1] - AbnormalFlag (OBX:8.1) is valued. If the OBX has *Numeric* data, all CE Susceptibility structures attached to the CE Microbiology structure searching for a structure which has:

1. Antibiotic Code equal to the Antibiotic code found for this OBX.
2. Susceptibility Test Code equal to that found from the OBR.
3. Detail Susceptibility Test Code equal to the Numeric Detail Susceptibility Test.

If one is found, it is updated as though it had never existed; with the exception of the Susceptibility Sequence Number field, which is not updated. If it is not found, a new CE Susceptibility structure is attached to the CE Microbiology structure and its fields valued. Please see the CE Susceptibility section.

It may seem odd to go through the trouble of searching for a matching susceptibility from the query results only to overlay its information, but it is necessary in order to find the Susceptibility Sequence Number. If it is not found, a new sequence number is created without deleting the one which is supposed to be replaced.

Unsuccessful Query

In this section it is assumed that the Clinical Event row was not found. Therefore, the creation of the entire request from a Susceptibility OBR is illustrated.

Clinical Event

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
clinical_event_id						Sequence number-system generated.
event_id						Sequence number-system generated.
valid_until_dt_tm					12/31/1200 00:00:00	Maximum date.
view_level					1	Hard-coded.
order_id						Not used.
person_id					person_id from ADT processing	
encntr_id					encntr_id from ADT processing	
accession_nbr					OBR:FillerField2	This is currently not being done. It needs to be fixed.
contributor_system_cd	89	Y	N			Resolved through general ESI processing.
reference_nbr					OBR:ParentFillerId + OBR:ParentFillerAppId + OBR:ParentObservationId + view_levelOBR:FillerOrderId + OBR:FillerOrderAppId + OBR:ParentObservationId + view_level	Option 2 is used only when the Parent Filler fields are not valued. This field, minus the view_level, comprises the base reference number.

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parent_event_id					event_id	It is a root event, so the parent_event_id and event_id are equal.
event_reltn_cd	24	N	N	ROOT		Hard-coded.
valid_from_dt_tm					Today	Hard-coded to current date/time.
event_class_cd	53	N	N	MBO		Hard-coded.
event_cd	72	Y	Y		OBR:ParentObservationId	
event_tag					OBR:ParentObservationId	
result_val						Not used.
result_units_cd						Not used.
result_time_units_cd						Not used.
event_start_dt_tm					OBR:ObservationDateTime	Defaults to OBR:ObservationEndDateTime.
event_end_dt_tm					OBR:ObservationEndDateTime	Defaults to OBR:ObservationDateTime.
event_end_dt_tm_os						Not used.
catalog_dept_cd						Not used.
catalog_type_cd						Not used.
catalog_cd						Not used.
series_ref_nbr						Not used.
task_assay_cd						Not used.
record_status_cd	48	N	N	ACTIVE		
result_status_cd	8	Y	N	ACTIVE, ANTICIPATED, AUTH, CANCELLED, IN ERROR, IN LAB, IN PROGRESS, MODIFIED, NOT DONE, SUPERCEDED, TRANSCRIBED, UNAUTH, UNKNOWN	AUTH	Hard-coded. This needs to be changed to be done in a way similar to the Culture OBR.
authentic_flag					1	Hard-coded.
publish_flag					1	Hard-coded.
qc_review_cd						Not used.
normalcy_cd						Not used.
normalcy_method_cd						Not used.
inquire_security_cd	87	N	N	ROUTCLINICAL		Hard-coded.
resource_group_cd						Not used.
resource_cd						Not used.
verified_dt_tm						Denormalized from ce_event_prsnl row with action of VERIFY.
verified_prsnl_id						Denormalized from ce_event_prsnl row with action of VERIFY.
performed_dt_tm						Denormalized from ce_event_prsnl row with action of PERFORMED.

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performed_prsnl_id						Denormalized from ce_event_prsnl row with action of PERFORMED.
normal_high						Not used.
normal_low						Not used.
critical_high						Not used.
critical_low						Not used.
expiration_dt_tm						Not used.
subtable_bit_map					logical *or* of subtables pre-assigned hex value	

CE Microbiology

Since this structure can be built using either an OBR or an OBX segment, the OBR options are written in *italic*.

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
event_id					ClinicalEvent---EventId	
micro_seq_nbr					OBX:ObservationSubId *OBR:ParentResult---OservationSubId*	Uniquely identifies this organism within its associated culture. Its name can change, but this number must always stay the same.
valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
valid_from_dt_tm					today	Current date.
organism_cd	1021	Y	Y		OBX:ObservationValue[1] - Value1-OBR:ParentResult - ObservationResult - Identifier	If this field is not valued on the obx, terminate processing of this message and post an error.
organism_occurrence_nbr					1	Hard-coded.
organism_type_cd	---------					Not used.
observation_prsnl_id						Not used.
biotype						Not used.
positive_ind					1	Hard-coded.
probability						Not used.

CE Susceptibility

Potentially, there can be two CE Susceptibility rows created for each OBX segment: one for the numeric result and one for the interpretive result. The Detail Susceptibility Test Code is determined as described in the Code Value Extensions section of this document. This structure is illustrated once. It specifies how both the numeric field and the interpretive field are filled out, but the reader should bear in mind that the two fields are not both filled out on the same instance of this structure. It there is both a numeric and interpretive result for a given OBX, the only difference between the two structures is the Susceptibility Sequence Number and which result field is filled out.

Field	Code Set	Translate	AOF	CDF Meaning	Set to.../Using...	Comments
event_id					ClinicalEvent---EventId	
micro_seq_nbr					CeMicrobiology---MicroSequenceNbr	
valid_until_dt_tm					12/31/2100 00:00:00	Maximum date.
suscep_seq_nbr						Generated by the Event Ensure.
valid_from_dt_tm					Today	Current date.
susceptibility_test_cd	65	Y	N		OBR:UniversalServiceId	

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detail_susceptibility_cd	1004	Y	N		See section on Code Value Extensions	Defaults to a code value with a Display Key of GENERICINT or GENERICNUM.
panel_antibiotic_cd						Not used.
antibiotic_cd	1011	Y	Y		OBX:ObservationId	
diluent_volume						Not used.
result_cd	64	Y	Y		OBX:AbnormalFlag[1]---AbnormalFlag	This is filled out if this is an Interpretive Result.
result_text_value					OBX:ObservationValue[1]---Value1	This is filled out if this is a Numeric Result.
result_numeric_value						Not used.
result_unit_cd						Not used.
nomenclature_id						Not used.
result_dt_tm					OBX:ObservationDateTime	
result_prsnl_id					OBX:ResponsibleObserver	Defaults to the personnel id associated with the contributor system.
susceptibility_status_cd	8	Y	N		If the SusceptibilityStatusCd already exists, change it to MODIFIED, otherwise set it to VERIFIED.	
abnormal_flag						Not used.
chartable_flag						Not used.
antibiotic_note						Not used.

Appendix A — Code Values

Listed below are the Code Value Aliases used by ESI in processing Discrete Microbiology Results to OCF. The AOF column indicates whether the code value and the alias are Added on the Fly (AOF). The CDF Meaning column indicates whether the alias needs to map to a code value with a pre-existing CDF meaning. The Translation Source Field column indicates the field, and context (Culture or Susceptibility, OBR or OBX, or Organism or Susceptibility) of the field being used as the alias.

Note
For some of the following code sets you are unable to update the code set directly in corecodebuilder.exe and must use the appropriate build tool identified below.

Code Set	Code Set Description	CDF	CDF Meaning	Translation Source Field	Database Build Tool
8	Auth Status	NO	YES	Report OBX, ObservationResultStatus (OBX:11) (defaults to that of the root-level Clinical Event if not found)	

Code Set	Code Set Description	AOF	CDF Meaning	Translation Source Field	Database Build Tool
8	Auth Status	NO	YES	Culture OBR, ResultStatus (OBR:25) or Culture ORC, OrderStatus (ORC:5)	
63	Succession Type	NO	YES	Culture OBR, ResultStatus (OBR:25) - Used for Report OBX segments when the succession type could not be resolved at the OBX level.	
64	Suscep Interp	YES	NO	Susceptibility OBX, AbnormalFlag[1]---AbnormalFlag (OBX:7.1)	MIC DB: Susceptibility: Susceptibility Results
65	Suscep Type	NO	NO	Susceptibility OBR, UniversalServiceId---Identifier (OBR:4.1)	MIC DB: Susceptibility: Susceptibility Procedures
72	Event Code	YES	NO	Report OBX, ObservationId---Identifier (OBX:3.1)	
72	Event Code	YES	YES	Culture OBR, UniversalServiceId---Identifier (OBR:4.1)	

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72	Event Code	YES	NO	Susceptibility OBR, ParentResult - ObservationId - Identifier (OBR:26.1.1)	
1011	Antibiotic Code	YES	NO	Susceptibility OBX, ObservationId---Identifier (OBX:3.1)	MIC DB: Susceptibility: Antibiotics
1021	Isolate /Organism	YES	NO	Susceptibility OBR, ParentResult - ObservationId - Identifier (OBR:26.1.1)	MIC DB: Organism
1021	Isolate /Organism	YES	NO	Organism OBX, ObservationId---Identifier (OBX:3.1)	MIC DB: Organism
1021	Isolate /Organism	YES	NO	Susceptibility OBR, ParentResult - ObservationResult - Identifier (OBR:26.3.1)	MIC DB: Organism
1901	Suscep Status	NO	YES	Susceptibility OBX, ObservationResultStatus (OBX:11)	
2051	Container Type	YES	NO	Culture OBR, SpecimenSource---Additives (OBR:15.2)	Collections DB: Specimen Containers

Appendix B — List Replace Examples

The following example shows the format for transactions using list replace option 3 to replace all CE_MICROBIOLOGY and CE_SUSCEPTIBILITY rows on a result.

```
MSH|^~\\&|
PID
OBR|1||TCRORD02-051299|KB||||199905121200||||||||||||||MB|P|C WOUND^1^STAPH
OBX|1|ST|CIPRO||4.0|||R|||P|||199905121330
OBX|2|ST|CARB||6.0|||S|||P|||199905130930
OBX|3|ST|BACIT||12|||S|||P|||199905131230
OBR|2||TCRORD02-051299|KB||||199905130945||||||||||||||MB|P|C WOUND^2^KLEOXY
OBX|1|ST|CIPRO||3.5|||R|||P|||199905151000
OBX|2|ST|CARB||5.2|||S|||P|||199905131015
```

This example shows a result with two organisms, aliased as STAPH and KLEOXY, and a few susceptibility results for each. So when using Option 3, any existing organisms and susceptibility results associated with C WOUND with filler number TCRORD02-051299 are removed and replaced with these two organisms and associated results.

Appendix C — Multiple Interp Examples

The following examples list the two ways to send the OBX segments for multiple interp results. The first has multiple interps in a single OBX and the second has multiple interps in separate OBXs.

Example 1:

```
MSH|^~\\&|
PID
ORC|RE
OBR|1||887654321|MIC||||199703060800||||||||||||||MB|
OBX|1|CE|ORGANISM|1|Staph||||||F|||199703061300
OBX|2|NM|AMP^Ampicillin|1|5.2||||||F|||199703061300
OBX|3|TX|AMP^Ampicillin|1||||BLOOD:IM:R~BLOOD:IV:S~BLOOD:PO:S|||F|||199703061300
```

Example 2:

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```
MSH|^~\\&|
PID
ORC|RE
OBR|1||887654321|MIC||||199703060800||||||||||||||MB|
OBX|1|CE|ORGANISM|1|Staph||||||F|||199703061300
OBX|2|NM|AMP^Ampicillin|1|5.2||||||F|||199703061300
OBX|3|TX|AMP^Ampicillin|1||||BLOOD:IM:R|||F|||199703061300
OBX|4|TX|AMP^Ampicillin|1||||BLOOD:IV:S|||F|||199703061300
OBX|5|TX|AMP^Ampicillin|1||||BLOOD:PO:S|||F|||199703061300
```


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