

AAMC Curriculum Inventory (CI) Business Rules

Last updated July 2021

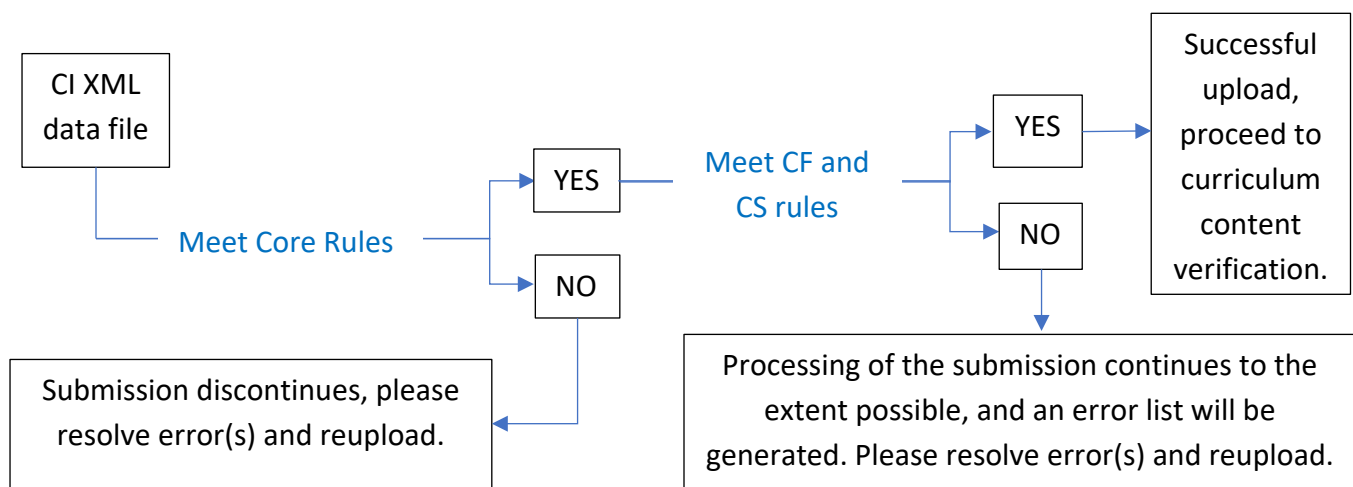
■ Introduction

This document describes the AAMC’s use of the [MedBiquitous CI and Competency Framework specifications](#). A CI XML data file must first comply with the MedBiquitous standard’s [XML schema](#). Then, when a CI XML data file is attempted to upload to the AAMC, either through the [CI Portal](#) or a Web service, it is checked for compliance with the AAMC CI business rules. These rules are required of schools who wish to participate in the annual AAMC CI upload process.

There are three categories of AAMC CI business rules:

1. Core rules (CR)
2. Competency Framework (CF)
3. Curriculum Inventory Structure (CS)

Once the CI XML data file meets core rules (CR), the XML file is made available on the Upload tab in the [CI Portal](#). If there are 1 or more CR errors, the XML file will not continue to process. Once all CR rules are met, the CI XML data file is then checked for compliance with CF and CS rules. The CF business rules relate to the MedBiquitous Competency Framework and Competency Object Specifications, and the CS business rules relate to the MedBiquitous CI Specifications.



Complementary resources such as the [CI Glossary](#), the [CI Portal User Guide](#), and the [Physician Competency Reference Set \(PCRS\)](#) are located on the [Resources to Establish Your CI](#) webpage.

■ Core Rules (CR)

Core rules must be met before additional business rules for the competency framework (CF) and the curriculum inventory structure (CS) are evaluated. If it is detected that a submission does not meet a core rule: a) processing of the submission discontinues, and b) an error notification window appears that describes the invalid core rule.

CR errors do not trigger email notifications.

Approved Sender?

- a. Senders must be certified via AAMC’s on-boarding process before the Web service will allow them to send submissions. A submission attempt from an uncertified Sender is rejected. It is not possible to send an error notification for this rule error. Unlike subsequent rules, this rule is evaluated as soon as a Sender attempts to connect to the Web service. Rule ID CR01
- b. Schools must select their data Sender via the CI Portal ‘Manage Sender’ tab. Before a submission is validated against core rules (CR), the AAMC verifies that the Sender (e.g., a vendor) has been selected by the school as their Sender. Rule ID CR02

Submission for One Curriculum Inventory?

- c. A CI XML data file must include data for only one CI for one school. Each submission therefore must have one <CurriculumInventory> tag, which is related to one <InstitutionID>. A submission that attempts to include data for multiple schools or CIs is rejected. Rule ID CR03

Institution Identified?

- d. The <InstitutionID> must match an AAMC institution ID for a school. If the institution ID does not match an AAMC-provided institution ID, the submission is rejected. Please contact ci@aamc.org if you do not know your AAMC institution ID. Rule ID CR04

Submission File Size Below 25MB?

- e. A CI XML data file is not allowed to exceed 25 megabytes in size. If the file is greater than 25MB, the submission is rejected. Files with size > 25MB can be compressed/zipped and uploaded. A compressed/zipped file may be larger than 25MB ; however, it is extremely unusual for a single zipped CI XML data file to exceed 25MB. Rule ID CR05

New for 2021: The maximum file size limit has been increased from 19MB to 25MB.

■ Competency Framework (CF) & Competency Object Rules

The following rules are evaluated only once all core rules (CR) have been met. If it is detected that a submission does not meet a competency framework or competency object rule, a) processing of the submission continues to the extent possible and b) upon completion of processing, an error email notification is sent to summarize all CF and CS rule errors.

As described in the following rules, **program-level-competencies are required. Each program objective must be mapped to one or more PCRS competency statement.**

<CompetencyObject> Tags

Within <Expectations>, <CompetencyObject> tags must be used to identify **all** competencies **except for PCRS** that are used throughout the <CurriculumInventory>. An error is generated if an event, sequence block, or program competency URI is referenced within <CurriculumInventory> without the presence of a corresponding <CompetencyObject> tag.

Rule ID CF01

<CompetencyObjects> may be referenced via their URIs by <Includes>, <Relation>, or <CompetencyObjectReference> tags.

a. Within <Expectations>, <CompetencyObject> tags cannot share the same URI. An error is generated if there are duplicate <CompetencyObject> tags within <Expectations>.

Rule ID CF02

b. Within <Expectations>, <CompetencyObject> tags must not be used to identify PCRS competencies. The CI will automatically integrate PCRS information (e.g., competency description) based on the URI. An error is generated if a <CompetencyObject> tag attempts to use a URI reserved by the PCRS framework. (See Appendix B.)

Rule ID CF03

c. The level of all <CompetencyObject> tags must be identified using the <Category> sub-element, as in the following example:

Rule ID CF04

```
<co:Category term="program-level-competency" />
```

Valid terms include:

- program-level-competency (i.e., program objectives)
- sequence-block-level-competency (i.e., course objectives)
- event-level-competency (i.e., event objectives)

An error is generated if a <CompetencyObject> does not have a <Category> sub-element with one of the above terms.

Note: This is of importance upon evaluation of <Relation> tags, as described in the ‘<Relation> Tags’ section below. Also, category terms are case sensitive, i.e., the term ‘Event-Level-Competency’ is not recognized as ‘event-level-competency’.

d. One or more <CompetencyObject> tags must exist with the “program-level-competency” <category> assigned. An error is generated if a submission does not include one or more program-level competencies.

Rule ID CF05

New for 2021: CF06 edited, with event-related error moved to CF17.

e. All sequence block-level <CompetencyObject> tags must have a corresponding <CompetencyObjectReference> tag within a <SequenceBlock> tag. An error is generated if a sequence block-level competency object is not referenced by at least one sequence block.

Rule ID CF06

f. The Title sub-element for each <lom> for each <CompetencyObject> should not contain characters outside of the Unicode Latin script and must contain at least one alphabetic character.

Rule ID CF16

g. The identifier and catalog sub-element for each <lom> must be defined for each <CompetencyObject>. An error is generated if no URI is provided for the competency object, or the URI catalog is not declared as <lom:catalog>URI</lom:catalog>.

Rule ID CF18

h. All event-level <CompetencyObject> tags must have a corresponding <CompetencyObjectReference> tag within an <Event> tag. An error is generated if an event-level competency object is not referenced by at least one event.

Rule ID CF17

New for 2021: CF18 and CF17 are new business rules.

<Includes> Tags

i. <Includes> tags should contain any competency – **including PCRS**, program-level, sequence block-level, and event-level competencies – that is subsequently used in a <Relation> tag. An error is generated if a <Relation> tag refers to a competency URI that does not have a corresponding <Includes> tag.

Rule ID CF07

j. The same URI cannot be present in two or more <Includes> tags. An error is generated if a duplicate URI is identified in <Includes> tags.

Rule ID CF08

<Relation> Tags

k. <CompetencyFramework> relationships that map program-level, sequence block-level, and event-level competency pairs must be specified in a <Relation> tag using either the #broader or #narrower relationship. Valid relationships are described by the relationship tables in Appendix A. An error is generated if a relationship of the aforementioned type is not specified **in conformance with the relationship tables**.

Rule ID CF09

l. All program-level competencies must be mapped to one or more PCRS competency statements. An error is generated if a program-level competency does not have a corresponding <Relation> tag that relates it to a PCRS URI.

Rule ID CF10

m. Program-level competencies may not be mapped to domain-level PCRS (e.g., 1.00 - 'Patient Care'). Program-level competencies must be mapped to PCRS such as 1.07 - 'Develop and carry out patient management plans' or 1.99 - 'Other Patient Care'). An error is generated if a program-level competency attempts to map to a domain-level PCRS URI.

Rule ID CF11

- n. Mapping of program-level competencies to PCRS must be specified in <Relation> tags using a #related relationship. An error is generated if a <Relation> tag that includes a PCRS URI uses a #broader or #narrower relationship.
- o. Mapping of sequence block-level or event-level competencies directly to PCRS is not allowed. They must be mapped through program-level competencies. An error is generated if a <Relation> tag includes a PCRS URI #related <Relationship> with any competency other than a program-level competency.
- p. Relationships must not result in circular references as described in the ‘Note about Hierarchical Conflict’ section (pp. 33-36) of the [Competency Framework Specification](#), version 1.0. An error is generated if a circular reference between competencies is detected.
- q. Several sub-elements and attributes of the CompetencyFramework or CompetencyObject elements are restricted in text length. The maximum allowable field lengths are summarized below. An error is generated if any field exceeds its maximum allowable length. Please note that this field size restriction relates to English characters; if any foreign characters are in the text, allowable characters size might reduce.

Rule ID CF12

Rule ID CF13

Rule ID CF14

Rule ID CF15

New for 2021: Reduction in character count limits for all elements listed here

Parent Element	Sub-element or Attribute	Max Length
CompetencyFramework	Lom:General:Title	1500
	Lom:General:Description	1500
CompetencyObject	Lom:Entry (i.e., URI)	1500
	Lom:Title	1500
	Lom:Description	1500

■ Curriculum Inventory Structure (CS) Rules

The following rules are evaluated only once all core rules (CR) as described on pages 1 and 2 have been met. If it is detected that a submission does not meet a curriculum inventory structure (CS) rule, a) processing of the submission continues to the extent possible and b) upon completion of processing an error notification is sent via email that summarizes all CS and CF rule errors.

<CurriculumInventory> Tag

- a. The <ReportID> sub-element must be unique for each of a school's submissions and may only use alphanumeric characters (i.e., no punctuation or symbols). An error is generated if a school's submission uses the same <ReportID> as one of its prior submissions or uses invalid characters in the <ReportID>. Rule ID CS01
- b. Submissions are checked to ensure they contain information for only the previous academic year (AY). Schools must submit data with <ReportingStartDate> and <ReportingEndDate> in between July 1 (of the previous year) and June 30 (of the current year). For example, in a submission for AY 2021, it would be an error if the reporting start date is before July 1, 2020. An error is generated if the <ReportingStartDate> does not precede the <ReportingEndDate>. Rule ID CS02

Note: Dates at the sequence block or event level are not checked to ensure they are within the previous academic year. Dates specified at these levels that fall within 8 years of the date range for a previous academic year will not cause an error or rejection.

<AcademicLevels> Tag

- c. The number of academic levels, or phases, are defined by <LevelsInProgram> and each academic level is defined as a <Level> within the <AcademicLevels> tag. An error is generated if there is a mismatch between <LevelsInProgram> and the number of <Level> tags. Rule ID CS03
- d. A <Level> that is not defined within the <AcademicLevels> tag cannot be referenced by a sequence block. An error is generated if a <SequenceBlock> attempts to refer to an undefined academic level. Rule ID CS04
- e. <Level> sub-elements of the <AcademicLevels> tag must have sequential numbers (i.e., the *number* attribute) starting with 1. An error is generated if a submission has academic levels that are not in a sequence or the sequence does not start with 1. An error is also generated if a submission has academic levels with duplicate level ID values. Rule ID CS05
- f. Each academic level must be referenced by at least one sequence block. An error is generated if a <Level> tag is not referenced by at least one <SequenceBlock> tag. Rule ID CS06

New for 2021: In CS05, clarified that academic level numbers cannot be duplicated.

<SequenceBlock> Tag

New for 2021: CS08 removed because it was duplicative with CS04.

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|----|---|--------------|
| g. | <SequenceBlock> tags must have unique identifiers (i.e., the <i>id</i> attribute). An error is generated if a <SequenceBlock> identifier is duplicated. | Rule ID CS07 |
| h. | The <Timing> sub-element of all <SequenceBlocks> tags must specify a <Dates> element. The <StartDate> must precede the <EndDate>. An error is generated if the start date and end date are not specified for a sequence block, or if the <StartDate> does not precede the <EndDate>. | Rule ID CS17 |
| i. | The <Timing> sub-element of <SequenceBlocks> tags with a <i>ClerkshipModel</i> attribute must specify <Dates> <u>and</u> <Duration>. An error is generated if the duration, start date, and end date is not specified for a clerkship sequence block. | Rule ID CS09 |
| j. | The <StartDate> and <EndDate> subelements of <Dates>, a subelement of <Timing>, must be no earlier or later than 8 calendar years before or after the <ReportingStartDate> and <ReportingEndDate>. | Rule ID CS20 |
| k. | The <StartDate> and <EndDate> subelements of <SequenceBlockEvent>, a subelement of <SequenceBlock>, must be no earlier or later than 8 calendar years before or after the <ReportingStartDate> and <ReportingEndDate>. | Rule ID CS21 |
| l. | The duration of a sequence block must be specified as a number of days. An error is generated if the <Duration> (sub-element of <Timing>) for a sequence block includes any units of time other than days. As described in rule CS09, duration is required for clerkship sequence blocks. | Rule ID CS16 |
| m. | When nesting sequence blocks, <SequenceBlockReference> must not result in circular references similar to those described for competencies in the 'Note about Hierarchical Conflict' section (pp. 33-36) of the Competency Framework Specification , version 1.0. An error is generated if a circular reference between sequence blocks is detected. | Rule ID CS10 |
| n. | A Sequence Block ID that is not defined by a corresponding <SequenceBlock> tag cannot be referenced by a sequence block. An error is generated if a <SequenceBlockReference> attempts to refer to an undefined sequence block. | Rule ID CS24 |

New for 2021: CS24 is a new rule.

<Event> Tag

- | | | |
|----|--|--------------|
| o. | <Event> tags must have unique identifiers (i.e., the <i>id</i> attribute). An error is generated if an <Event> identifier is duplicated. | Rule ID CS11 |
| p. | All <Event> tags must be referenced by at least one <SequenceBlockEvent> tag within a <SequenceBlock>. An error is generated if an <Event> is not referenced by one or more <SequenceBlock>. | Rule ID CS15 |
| q. | An Event ID that is not defined by a corresponding <Event> tag cannot be referenced by a sequence block. An error is generated if a <SequenceBlock> attempts to refer to an undefined event. | Rule ID CS18 |

- r. Within <Event> tags, the <ResourceType>, <InstructionalMethod>, and <AssessmentMethod> tags must reference a unique ID from their respective vocabularies, as in the following example.

```
<Event id="E1">
  <Title>White Coat Ceremony</Title>
  <EventDuration>PT2H</EventDuration>
  <Description>First year students are given their white coats to mark the transition to
  clinical rotations. The ceremony includes a declaration of professional
  values.</Description>
  ...
  <ResourceType>RE002</ResourceType>
  <InstructionalMethod primary="true">IM013</InstructionalMethod>
  <AssessmentMethod purpose="Summative">AM012</AssessmentMethod>
</Event>
```

The **CI Standardized Vocabulary for Instructional Methods, Assessment Methods, and Resources** can be accessed from the [Resources to Establish Your CI](#) webpage. This resource includes the unique identification codes (i.e., UIDs) for each instructional method, assessment method, and resource, which are used within the CI XML data file to identify each method or resource used for a given educational event.

An error is generated if a <ResourceType> does not match the unique ID of a resource, an <InstructionalMethod> does not match the unique ID of an instructional method, or an <AssessmentMethod> does not match the unique ID of an assessment method.

- s. At a minimum, each <Event> must reference **at least one** <InstructionalMethod> or <AssessmentMethod>. An error is generated if an <Event> does not reference any <InstructionalMethod> or <AssessmentMethod>.

Note: An <Event> may contain a combination of both instructional and assessment method tags.

- t. If one or more <InstructionalMethod> tags are provided, one **and only one** must be denoted as the primary. An error is generated if two or more <InstructionalMethod> tags are marked as primary.

- u. Several sub-elements and attributes of the CurriculumInventory, Institution, SequenceBlock and other elements in the curriculum structure are restricted in text length. The maximum allowable field lengths are summarized below. An error is generated if any field exceeds its maximum allowable length. Please note that this field size restriction is for English characters; if any foreign characters are in the text, allowable characters size might reduce.

Parent Element	Sub-element or Attribute	Max Length
CurriculumInventory	ReportID	100
	Title	4000

Rule ID CS12

Rule ID CS13

Rule ID CS14

Rule ID CS19

New for 2021: CS13 remains, but note it is not possible to trigger this error because this would be caught by validating against the MedBiq XML schema.

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New for 2021:
Reduction in character count limits in elements: ReportID, EventTitle, SequenceBlockTitle

Resources removed from having a character count because the only acceptable entry for "Resources" are their respective ID codes (e.g., RE001).

EventDuration character count added

	ReportDate	100
	ReportingStartDate	100
	ReportingEndDate	100
	Language	100
	Description	4000
	SupportingLink	2048
Institution	InstitutionName	4000
	Address:Organization	500
	Address:StreetAddressLine	200
	Address:City	100
	Address:StateOrProvince	100
	Address:PostalCode	40
	Address:Region	100
	Address:District	100
	CountryName	50
	CountryCode	15
	AddressCategory	15
Program	ProgramID	200
	ProgramName	4000
	EducationalContext	4000
	Profession	500
	Speciality	500
Event	ID	30
	Title	2000
	EventDuration	15
	Description	4000
	Keyword	4000
Level	Label	50
	Description	4000
Sequence	Description	4000
SequenceBlock	ID	15
	Title	2000
	Description	4000
	Minimum	3
	Maximum	3
	Timing:Dates:StartDate	100
	Timing:Dates:EndDate	100
	Precondition	4000
	Postcondition	4000

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	SequenceBlockReference:Order	3
SequenceBlockEvent	StartDate	100
	EndDate	100
Integration	Description	4000
IntegrationBlock	ID	15
	Title	4000
	Description	4000

■ Appendices

Appendix A. Valid Competency Framework (CF) Relationships

There are three types of relationships one may express using the <Relation> tag:

- narrower (or “has narrower concept”)
- broader (or “has broader concept”)
- related (“is related to concept”)

The following two examples of hierarchical relationships are logically equivalent:

<A> skos:narrower <D> → <D> has a narrower concept than <A>
<D> skos:broader <A> → <A> has a broader concept than <D>

The following two examples of ‘related’ relationships are logically equivalent:

<A> skos:related <C> → where <C> is related to <A>
<C> skos:related <A> → where <A> is related to <C>

Competency relationships are defined within the <CompetencyFramework> tag using a <Relation> tag. In the following fictitious example, a #related relationship is drawn between two competencies.

```
<cf:Relation>  
  <cf:Reference1>  
    <cf:Catalog>URI</cf:Catalog>  
    <cf:Entry>http://medicine.osu.edu/competencies/pc_1_2_1</cf:Entry>  
  </cf:Reference1>  
<cf:Relationship>http://www.w3.org/2004/02/skos/core#related</cf:Relationship>  
  <cf:Reference2>  
    <cf:Catalog>URI</cf:Catalog>  
    <cf:Entry>https://services.aamc.org/30/ci-school-web/pcrs/PCRS.html#aamc-pcrs-comp-  
    c0101</cf:Entry>  
  </cf:Reference2>  
</cf:Relation>
```

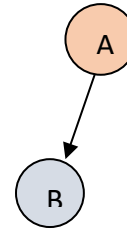
The following tables and diagrams depict relationships between competencies.

✓ indicates a valid relationship per the CI profile of the MedBiquitous CI standard.

X indicates an invalid relationship. An error is generated if an invalid relationship is detected, as described above in the '<Relation> Tags' section.

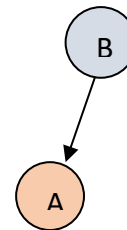
**<A> skos:narrower **

<A>				
	PCRS	Program-level Competency	Sequence block-level Competency	Event-level Competency
PCRS	X	X	X	X
Program-level Competency	X	X	✓	✓
Sequence block-level Competency	X	X	✓	✓
Event-level Competency	X	X	X	✓



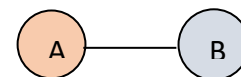
**<A> skos:broader **

<A>				
	PCRS	Program-level Competency	Sequence block-level Competency	Event-level Competency
PCRS	X	X	X	X
Program-level Competency	X	X	X	X
Sequence block-level Competency	X	✓	✓	X
Event-level Competency	X	✓	✓	✓



**<A> skos:related **

<A>				
	PCRS	Program-level Competency	Sequence block-level Competency	Event-level Competency
PCRS	X	✓	X	X
Program-level Competency	✓	X	X	X
Sequence block-level Competency	X	X	X	X
Event-level Competency	X	X	X	X



Appendix B. Physician Competency Reference Set (PCRS)

References to competencies in the PCRS are required to create a valid CI XML submission. The related requirements are described in the ‘Competency Framework (CF) & Competency Object Rules’ section above (e.g., see rule ID CF10).

Uniform Resource Indicators, or URIs, are used to reference school competencies and AAMC-defined competencies in the [PCRS](#). For example, the URI for the first PCRS competency is: <https://services.aamc.org/30/ci-school-web/pcrs/PCRS.html#aamc-pcrs-comp-c0101>

The portion of the URI in bold may be changed to any ‘Partial URI’ value listed in the [PCRS and their partial URIs table](#) – except those denoted by an asterisk – to reference the corresponding competency.

Note: * denotes domain-level PCRS competencies which, according to rule ID CF11, may not be referenced within a CI submission.

Appendix C. Business Rules Glossary

Abbreviations

CF = Competency Framework
CI = Curriculum Inventory
CS = Curriculum Inventory Structure
URI = Universal Resource Identifier

Terms

Competencies. The CI implementation recognizes different levels of competencies: PCRS, Program-level, Sequence-level, and Event-level. Each is described in their respective definitions below.

Error. If one or more rules are not met, then an error is generated. Error notifications are sent via email to applicable school users with a description of the rule(s) not met and the specific failures under each rule.

Event-level competencies. School competencies that are categorized as event-level, often referenced by events.

PCRS. Physician Competency Reference Set; an external competency framework provided by AAMC.

Program-level competencies. School competencies that are categorized as program-level, which may be mapped to event and sequence block-level competencies. Program-level competencies must be mapped to the PCRS.

Sequence block-level competencies. School competencies that are categorized as sequence block-level, often referenced by events.

Sender. A vendor or school that submits an XML file. Senders must be certified via AAMC’s onboarding process before the web service allows them to submit on behalf of a school.