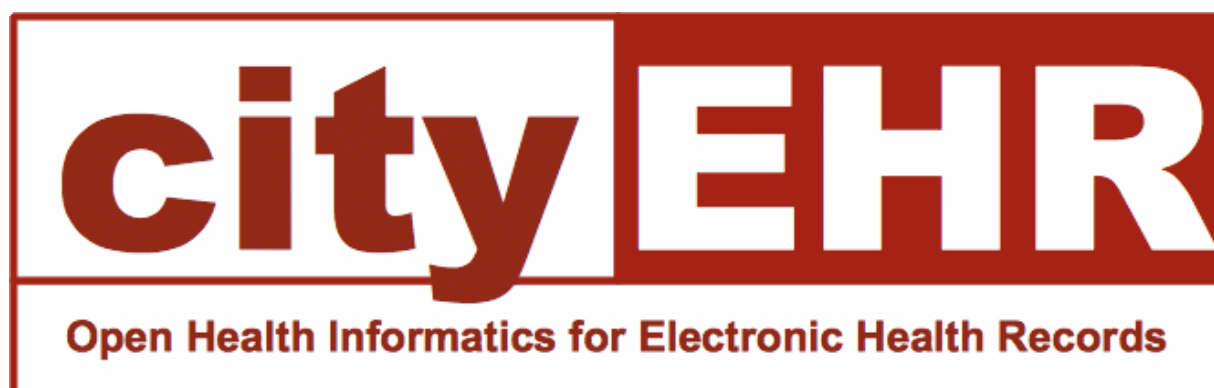




cityEHR Information Modelling Guide - Quick Reference

Open Health Informatics

John Chelsom

15th February 2025

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Revision History

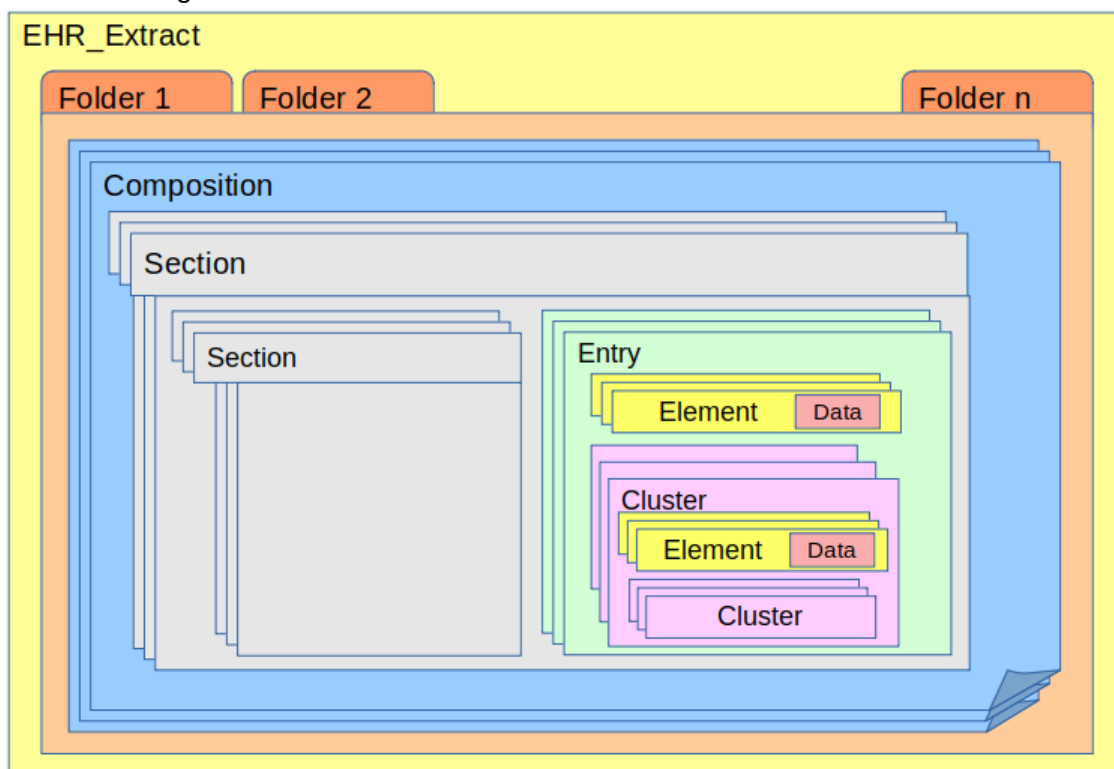
Date	Version	Changes	Owner
01 Apr 2023	1.0	First Version	JC
01 Apr 2024	1.1	Revised for V2 Model	JC
15 Feb 2025	1.2	First comprehensive version, covering all properties	JC

1. Introduction

This document provides a quick reference guide to creating information models for cityEHR. Within cityEHR, models are stored and manipulated as OWL/XML ontologies but they can be created and visualised using a variety of tools that generate XML representations of the models. These representations can then be transformed to OWL/XML and uploaded to cityEHR through the Administration page, using the menu selection Information Model | Import Model.

The ontology models define the basic structure of ISO 13606 Compositions and their allocation to Folders, which in cityEHR correspond to care settings such as clinical specialties (Rheumatology, Pulmonary, Liver & Biliary, etc) or departments such as Maternity, Emergency Room, Ambulatory Care, etc.

The overall architecture (called the Reference Model) of an Electronic Health Record in ISO 13606 is shown in Figure 1.

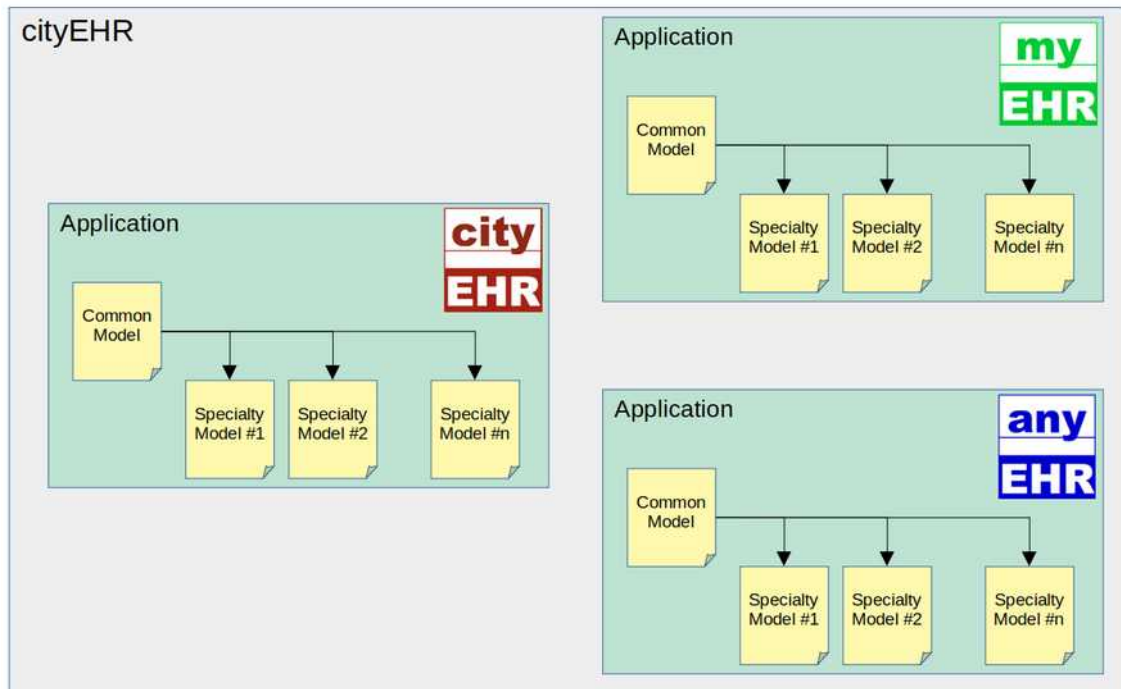


As well as the basic structure of ISO 13606, the cityEHR ontology models define additional attributes that control the operation of the health records application and the behaviour of the information as users (clinicians) interact with the record structures.

In ontology terms, these attributes are either Object Properties or Data Properties. The Object Properties define relationships between two individuals in the ontology, which for cityEHR's information models means that the clinical modeller chooses from a set of defined values for the property. A summary of the ontology representation of cityEHR models is provided in Appendix 1.

The Data Properties define relationships between an individual in the ontology and a string literal, which means that the clinical modeller defines the values of those string literals.

A single cityEHR installation can be configured to support multiple EHR applications, each with its own information model. Within a single application there can be multiple specialty models which share a common model. Typically the specialty models correspond to clinical specialties or departments in a care provider organisation. One information model for the application can be designated as the Common Model; this is shared between all specialties, so that any common components can be shared between them.



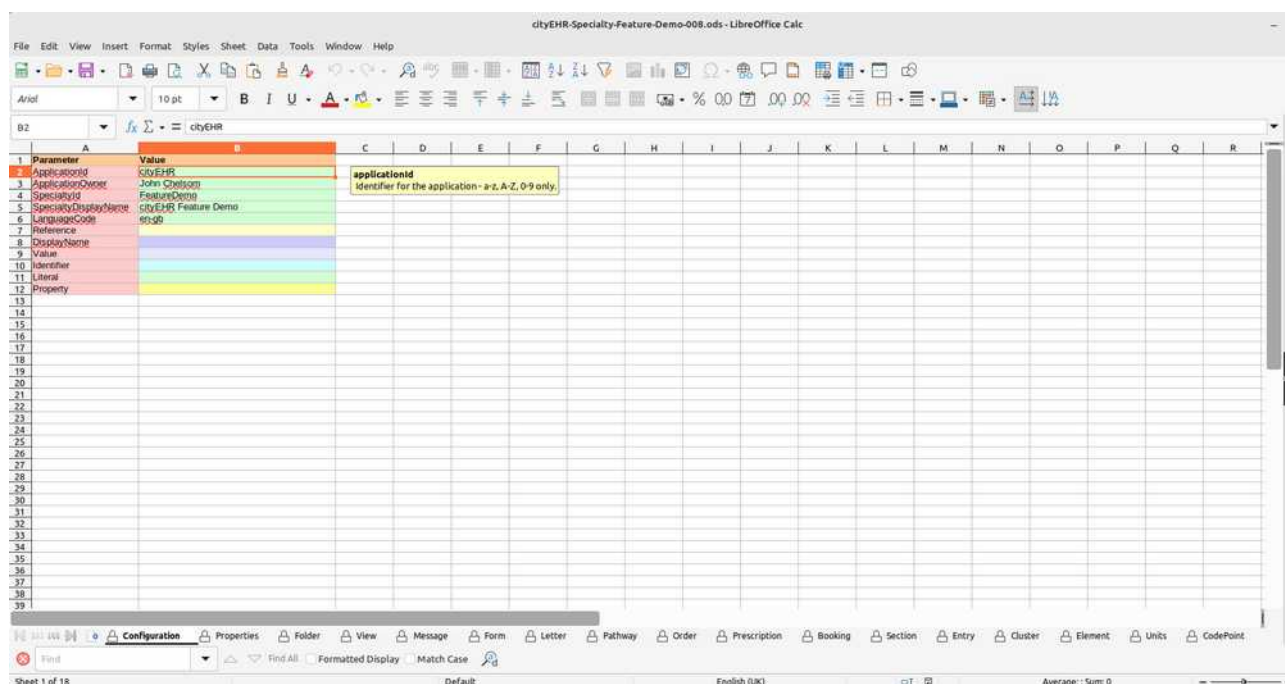
Each user is assigned to one or more specialties;. On sign on the user's (single) specialty model will be loaded, or if they have been assigned to more than one specialty then they can select which specialty to use for the session. Once started, the specialty is fixed for the user's session, although there are some functions (particularly in the Administration page) where the specialty can be chosen for that particular function; this does not change the specialty for the session itself.

There are several ways in which new clinical information models can be created:

- extend the models shipped by default with cityEHR
- create new specialty models for the default application
- create a new application with its own base and specialty models

2. Modelling Using LibreOffice Spreadsheets

The main tooling used for creating and editing information models in cityEHR is the open source LibreOffice spreadsheet (LibreOffice Calc).



Template spreadsheets ship with cityEHR, as well as the example models for the Feature Demo specialty that is configured 'of the box'.

Two important options must be configured in LibreOffice to ease the modelling process.

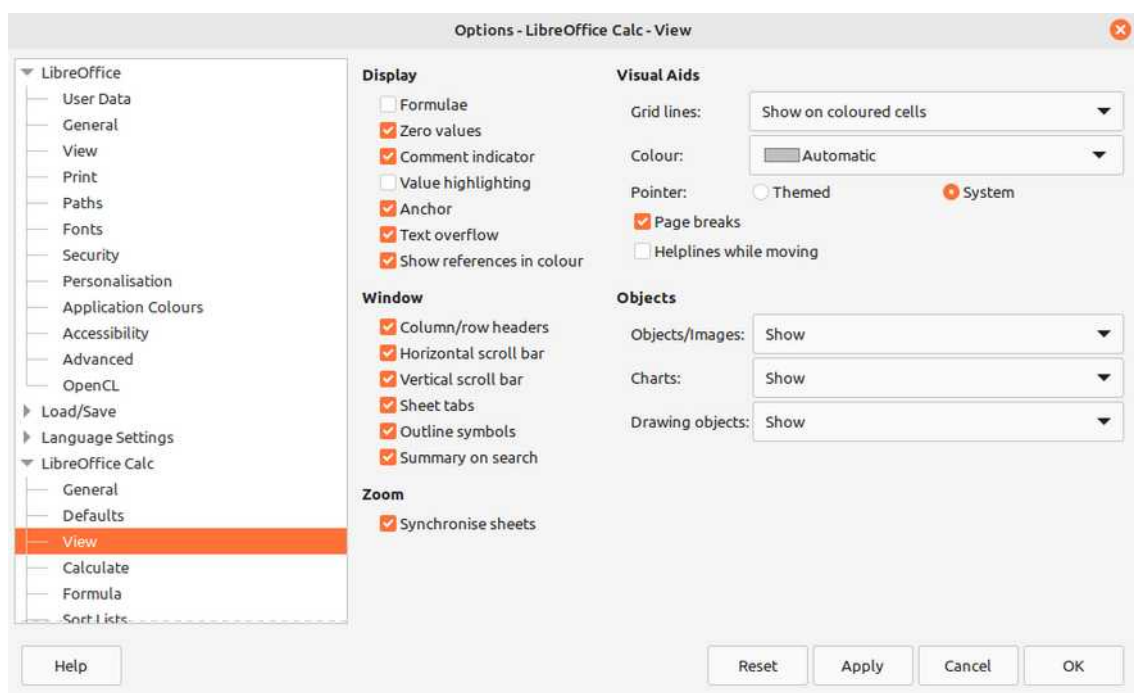
1. Turn on display of grid lines. Here is the display of the first sheet without gridlines.

	A	B	C	D	E
1	Parameter	Value			
2	ApplicationId	cityEHR	applicationId Identifier for the application - a-z, A-Z, 0-9 only.		
3	ModelOwner	John Chelsom			
4	SpecialtyId	cityEHRBase			
5	SpecialtyDisplayName	cityEHR Base (Common) Model			
6	LanguageCode	en-gb			
7	Reference				
8	DisplayName				
9	Value				
10	Identifier				
11	Literal				
12	Property				
13	Architecture Version	2025			
14					

2. To switch gridlines on, select the option in View | Show Gridlines.

	A	B	C	D	E
1	Parameter	Value			
2	ApplicationId	cityEHR	applicationId Identifier for the application - a-z, A-Z, 0-9 only.		
3	ModelOwner	John Chelsom			
4	SpecialtyId	cityEHRBase			
5	SpecialtyDisplayName	cityEHR Base (Common) Model			
6	LanguageCode	en-gb			
7	Reference				
8	DisplayName				
9	Value				
10	Identifier				
11	Literal				
12	Property				
13	Architecture Version	2025			
14					

- If the gridlines are still not showing, then select Tools | Options | Libreoffice Calc | View and select the option to show gridlines on coloured cells.



- Ensure that Libreoffice uses balanced, straight quotation marks ' single quotes' and "double quotes", not angled quotes.

'quote'

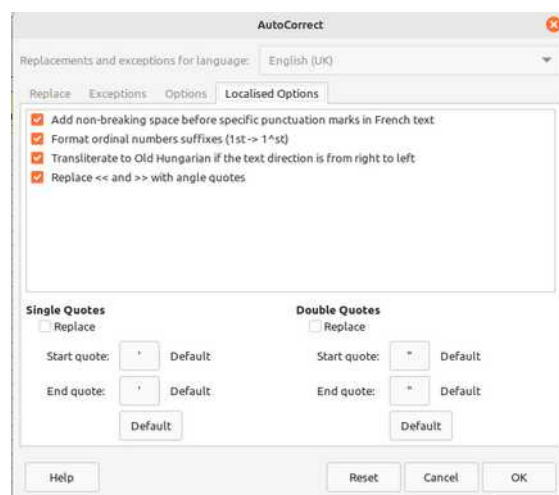
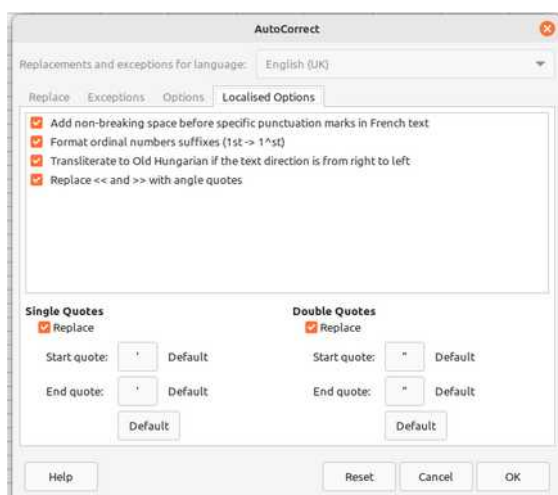
Angled quote

'quote'

Straight quote

B2		$\sum$	=	cityEHR 'quote'
1	Parameter	Value		
2	ApplicationId	cityEHR 'quote'		
3	ApplicationOwner	John Chelson		
4	SpecialtyId	FeatureDemo		
5	SpecialtyDisplayName	cityEHR Feature Demo		
6	LanguageCode	en-gb		
7	Reference			
8	DisplayName			
9	Value			
10	Identifier			
11	Literal			
12	Property			
13				

- To prevent the auto-correction of straight quotes to angled quote use Tools (Menu) | AutoCorrect | AutoCorrect Options. . . Localised Options



3. Configuration Sheet

The

	A	B	C
1	Parameter	Value	
2	ApplicationId	cityEHR	
3	ModelOwner	John Chelsom	
4	SpecialtyId	cityEHRBase	
5	SpecialtyDisplayName	cityEHR Base (Common) Model	
6	LanguageCode	en-gb	
7	Reference		
8	DisplayName		
9	Value		
10	Identifier		
11	Literal		
12	Property		
13	Architecture Version	2025	
14			
15			

Sheet 1 of 18

Configuration Properties Folder View Message Form

Default

Parameter	Description
ApplicationId	The identifier for the cityEHR application that is driven by this model. The file can only be loaded for the application with this identifier, <i>Required</i>
ModelOwner	Name of the model owner – copyright is asserted in the ontology
SpecialtyId	The identifier for the specialty (folder) for this model. <i>Required</i>
SpecialtyDisplayName	The display name (title) for the specialty
LanguageCode	The pair of ISO 639-1 language code and ISO 3166-1 Alpha-2 country code. For example en-gb (which is the default).

Field Type	Colour	Description
Reference		A reference to an ISO 13606 component, selected in a dropdown menu
DisplayName		The display name (title) of an ISO 13606 component or data value.
Value		A (categorical) value of the Data for an ISO 13606 Element
Identifier		The identifier for an ISO 13606 component. Must be unique on each sheet (i.e. for each component type). A-z, A-Z, 0-9, -, _, . (dot) only.
Literal		The string literal for a data property, including calculations.
Property		The value of an object property, selected in a dropdown menu

4. Properties Defining the Structure of the Health Record

Most of these properties are available for most ISO-13606 Components, as listed, and define the basic structure of the health record and the relationship between Components.

Property	Where Used	Values	Description
Identifier	Folder Composition Section Entry Cluster Element Unit CodePoint	A string containing one or more of the characters a-z, A-Z, 0-9, -, _, . (dot). Must be unique for the sheet it appears on (i.e. across all components of that type)	Unique identifier for the ISO-13606 component. The id is used to create the structured representation of ISO 13606 through links between the identified components.
Extension	Entry Element	String of the form: ComponentType:Identifier e.g. Element:Date Entry:BloodPressure	The extension to the identifier. The purpose of the extension is to allow for specialization of identified components. The component Identifier is used to define the structure of the health record, but the Extension is used in calculations. This means that the same component (same extension) can be defined with different behaviours (specified for components with different Identifiers, referring to the same Extension) Selected from the existing identifiers of the relevant component type. If no Extension is specified for a component then it defaults to be the same as the Identifier
DisplayName	Folder Composition Section Entry Cluster Element Unit CodePoint	String	Label displayed to describe the component. .
Information	Entry	Entry:<entry name>	An Entry displayed in the Information

Property	Where Used	Values	Description
			pane of the user interface that can contain additional information about the Entry to which it is associated. The Information Entry is displayed as Read Only but can include calculations. This could be used (for example) to display a different URL to external information, depending on the values of Elements in the associated Entry.
EntryRelationship	Entry of the EntryType: Encounter SubstanceAdministration Supply	Entry:<entry name>	Used to define additional information about an • Encounter - details of the booking • SubstanceAdministration – details of the medication being prescribed • Supply – details of the test being ordered.
Subject	Entry	Entry:<entry name>	The Composition that is the subject of an Act. Only selectable if the Entry has an EntryType of Act.
SortCriteria	Entry	Element:<ElementId>	The Element used to sort a MultipleEntry or as the key to look up the value of a directory Entry.
CategorizationCriteria	Entry	Element:<ElementId>	The Element used to categorize a MultipleEntry. The multiple entries are split into categories – one category for each value of the Element specified as the CategorizationCriteria. This Element must exist as content of the Entry.
Contents	Folder Composition Section Entry Cluster	List of Identifiers of ISO 13606 components.	List of sub-components contained within the component. Select from the dropdown that lists Identifiers from the relevant sheet(s). The Contents define the structure of ISO 13606 components.
Data	Element	A set of pairs of DisplayName (String) and Value (String)	The DisplayName (required) is used in selection and display to users; the Value (optional) is the data value recorded in the patient record (and used in calculations). If it is not specified, the Value defaults to the

Property	Where Used	Values	Description
			DisplayName.
Unit	Element	List of Identifiers of Unit components. String of the form: Unit:<UnitId>	The units of measurement for a data value, selected from the defined Units.

5. Object Properties

These properties takes values from a defined set, as listed on the Properties sheet. They are selected through dropdown menus in the relevant spreadsheet field which set the value of the property.

Property	Values								
ISO-13606	EHR_Extract	Folder	Composition	Section	Entry	Cluster	Element		
Sequence	Ranked	Unranked							
SectionContext	Composition	Pathway	Order	Prescription	Booking				
CRUD	CRUD	R	CR	CRU	CRD	UL	L		
Occurrence	Single	MultipleEntry							
InitialValue	Empty	Pre-filled	DistinctValues	AllValues	Default	Transient			
DataType	string	date	dateTime	time	duration	dayTimeDuration	yearMonthDuration	double	integer
EntryType	Observation	Act	Supply	SubstanceAdministration	Encounter				
RequiredValue	Optional	Required							
ViewType	Folder	Composition	Report						
Rendition	Form	ImageMap	Image	Denoted	Enumerated	Standalone	Chart	Highlighted	Hidden
ElementType	simpleType	patientMedia	calculatedValue	staticValue	enumeratedValue	enumeratedCalculatedValue	enumeratedClass	enumeratedDirectory	memo
CohortSearch	Searchable	PrimarySearch	NotSearchable						
SortOrder	Ascending	Descending							
Scope	Defined	Full							
Axis	Composition	Section	Entry						
CodeSystem	SNOMED	ICD-10	LOINC						

Property	Where Used	Values
ISO-13606	For information only	Components from the ISO 13606 Reference Model - EHR_Extract - Folder - Composition - Section - Entry - Cluster - Element
Sequence	Section Entry Cluster	Determines the layout of components contained in a Section for Compositions. In addition, for Pathway compositions the Sequence determines whether the contained activities (Acts) are to be performed in sequence or in parallel. - Ranked - sequentially, one after the other, laid out vertically - Unranked - concurrently, in parallel, laid out horizontally
SectionContext	Section	The context in which the Section is used – either Composition (which covers Message, Form and Letter) or one of the composition types on named sheets. On the sheets for those compositions the Content fields are selected from Sections of the corresponding SectionContext for the composition. - Composition - Message, Form or Letter - Pathway - Order - Prescription

Property	Where Used	Values
		Booking
CRUD	Entry	Restrictions on how an Entry is created, read, updated or deleted - CRUD - no restriction - Create, Read, Update, Delete - R - Read only. The contents are displayed but the user cannot interact. - CR - Create and Read. New Entries can be added to a multiple entry (as determined by its Occurrence) but and existing pre-filled Entries are read-only. - CRU - Create, Read and Update - CRD - Create, Read and Delete - UL - Lookup in directory and then Update. The complete Entry is retrieved from the Directory of Entries for that identity using the key Element specified in the - L - Lookup in directory (fixed value)
Occurrence	Entry	The cardinality of the Entry (one or many) - Single - one instance of the Entry - MultipleEntry - multiple instances of the Entry can be created
InitialValue	Entry	How the Entry is instantiated when the Composition is loaded - Empty – all Element values are empty (blank, not set) - Pre-filled – set with the most recent values in the patient record (for both Single and MultipleEntry) - DistinctValues – for MultipleEntry, set with the set of distinct Entries ever recorded - AllValues – for MultipleEntry, set with the set of every Entry ever recorded - Default – the initial value is calculated from the expression in DefaultValue - Transient – set with the most recent values in the patient record for initial calculations, then reset to Empty once the Composition is loaded.
DataType	Element	For the value of Data in an Element - these are datatypes from the XML Datatypes standard (xs:string, xs:date, etc) - string - date - dateTime - time

Property	Where Used	Values
		• duration • dayTimeDuration • yearMonthDuration • double • integer • boolean • anyURI • base64Binary
EntryType	Entry	The HL7 CDA entry type. This determines the SectionContext in which the Entry can be selected. If the EntryType is not set, then the Entry cannot be used, since it won't appear in the drop down selection for the Contents of any Section. The EntryType also determines the HL7 CDA element that is generated. • Observation - used in SectionContext of Composition • Act - used in SectionContext of Pathway • Supply - used in SectionContext of Order • SubstanceAdministration - used in SectionContext of Prescription • Encounter - used in SectionContext of Booking
RequiredValue	Element	• Optional - the Data value can be left blank • Required - the user must fill in the Data value
ViewType	View	• Folder - the view retrieves all the Composition(s) listed in the Content • Composition - the view retrieves the Data value for every Element in the Composition listed in the Content • Report - the view generates a report by filling out the InitialValue (usually the calculated Default value) of each Element in the Composition listed in the Content
Rendition	Entry	The way in which the Entry is rendered on screen for user interaction • Form - regular interaction using form-based controls (default) • ImageMap - graphical interaction using an image map (which must be loaded through the Administration page) • Image - displayed as a static image (which must be loaded through the Administration page) • Denoted - form-based with each Element preceded by a bullet point icon

Property	Where Used	Values
		- Enumerated - form-based with each Element preceded by a number - Standalone - displayed in a pop-out (not yet supported) and printed on a new page - Chart - displayed as a chart generated from historic values of each Element - Highlighted - - form-based, emphasized - Hidden - not displayed to the user, but recorded in the record when the Composition is committed
ElementType	Element	The type of the element (in addition to the DataType of the Data contained in the element) - simpleType - user control for data entry is based on the DataType - patientMedia - upload control for user to select external media - calculatedValue - value is calculated using the expression in CalculatedValue (not directly editable by the user) - staticValue - a static value calculated from the DefaultValue (then not editable by the user) - enumeratedValue - user selected from one of the values defined for the Element in the Data - enumeratedCalculatedValue - user selected from one of the values defined for the Element from evaluation of the CalculatedValue - enumeratedClass - user selected from one of the values defined in the Class for the Element - enumeratedDirectory - user selected from one of the values defined in the Directory for the Element - memo - for DataType string - displays a larger memo field - range - for DataType integer - displays a range slider between the two values listed in the Data - url - the value (usually a static default value) is displayed as a clickable link - age - set to the current patient age (set as a xs:duration) - icon - displayed as small inline image
CohortSearch	Entry	- Searchable - is listed for selection in the Cohort Search page - PrimarySearch - is listed in the primary selection in the Cohort Search page

Property	Where Used	Values
		NotSearchable - is not available for searching in the Cohort Search page
SortOrder	Entry	For a Multiple Entry only (Occurrence = MultipleEntry) - Ascending - entries are sorted in ascending order (using the SortCriteria Element or the first Element in the Entry, if no SortCriteria) - Descending- entries are sorted in descending order (using the SortCriteria Element or the first Element in the Entry, if no SortCriteria)
Scope	Entry Element	For Multiple Entry (Occurrence = MultipleEntry) or Element - Defined - the user selects from the set of available values, which are not displayed until the user interacts - Full - all available values are displayed for selection
Axis	Composition	For alignment of Entry and Element on a Composition - Composition - the same alignment is used for the whole Composition - Section - the best alignment is used for each Section - Entry - the best alignment is used for each Entry
CodeSystem	CodePoint	The coding system of the Code value - SNOMED - ICD-10 (can be changed to ICD 11) - LOINC - Additional coding systems can be added to this list

6. Data Properties for Expressions

Expressions are used in the following data properties:

Property	Where Used	Description
Conditions	Section Entry Cluster Element	Result of the expression is cast to xs:boolean The Condition is evaluated continuously as the containing Composition is edited by the user. If the Condition evaluates to true then the component is in-scope, if the Condition evaluates to false then the component is out-of-scope. Any out-of-scope component has its visibility set to false, is hidden from the user, does not get used in other calculations and is removed from the Composition before it is committed to the patient record.
Pre-conditions	Section Entry	Result of the expression is cast to xs:boolean These pre-conditions are evaluated once, when the Composition is loaded; any out-of-scope component is removed from the Composition before any user interaction begins.
EvaluationContext	Section Entry	Conditions used to constrain the Compositions in the record from which default values for any Elements in the component are calculated when the Composition is loaded.
Constraints	Element	Result of the expression is cast to xs:boolean An expression that is evaluated as the user enters the value of Data for the Element; if the Constraints evaluates to false then the value entered by the user is removed (replaced by an empty value)
DefaultValue	Element	Result of the expression is cast to the DataType of the Element An expression that is evaluated when the Composition is loaded; result is set as the initial value of the Element Data. Note that the evaluation is also determined by the InitialValue property of the containing Entry, which must be set to either Default or Pre-filled. For Default, the default value is set as the result of the expression or is left empty if no default expression is specified. For Pre-filled entries, any default values are calculated only if there is no existing Entry of that type recorded for the patient.
CalculatedValue	Element	Result of the expression is cast to the DataType of the Element The CalculatedValue is evaluated continuously as the containing Composition is edited by the user. The result of the CalculatedValue expression sets the Data value of Elements that are of type calculatedValue For Elements of type enumeratedCalculatedValue, the result of the expression should be a sequence of values (a, b,c, etc) that then constrains the Data values for the Element that can be selected by the user.

The expression language used by cityEHR is XPath, with some additional built-in functions and the ability to reference the data value of Elements using the convention:

EntryId/ElementId,

where ElementId is the identifier of an Element contained in the Entry with identifier EntryId.

Expressions use the XPath expression language (version 2) as defined by the W3C standard at:

<https://www.w3.org/TR/xquery-operators/>

In the context of cityEHR expressions the data value of an Element is represented as EntryId/ElementId, so for example in the expression

ScanDate/Date – Demographics/DateOfBirth

ScanDate/Date is the value of the Element with the identity Date in the Entry with the identity ScanDate and

Demographics/DateOfBirth is the value of the Element with identity DateOfBirth in the Entry with the identity Demographics

The result of the expression is cast to the data type defined by the DataType of the Element (when used in Default Value or CalculatedValue) or as xs:boolean (for Conditions, Pr-conditions and Constraints)

Expressions can also use extension functions that are specific to cityEHR, as shown in the following table. Here elementRef represents the pair EntryId/ElementId

Function	Description
cityEHR:getValues(elementRef) cityEHR:getValues(elementRef, conditions)	Returns a sequence of values for the elementef – this is all values that have been recorded in the longitudinal record. Where the conditions parameter is supplied this is an Xpath expression used to filter the value returned and is evaluated relative to the return sequence. So for example the conditions [. lt 60] would filter the sequence to values less than 60.
cityEHR:distinctValues(elementRef) cityEHR:distinctValues(elementRef, conditions)	As getValues, but returns the sequence of distinct values found. So the sequence does not contain any repeats of the same value.
cityEHR:lookup(directoryElement, keyValue)	Looks up the keyValue in the directory specified by the directoryElement parameter. The keyValue is an Xpath expression that can be a string literal (must be quoted) or an elementRef
cityEHR:instance(instanceld, path)	Returns the result of the path in the XForms instance specified by the instanceld parameter. This function requires knowledge of the cityEHR code in order to specify the instanceld.
cityEHR:getAttribute(elementRef, attributeld)	Returns the value of the XML attribute named by the attributeld parameter on the element specified as the elementRef

Examples of expressions from the default Feature Demo application are shown in the table below.

Type	Example Expression
Calculated Value	0
Calculated Value	'today'
Calculated Value	'P7D'
Calculated Value	Current-date()
Calculated Value	ClinicDetails/ClinicCode
Calculated Value	ScanDate/Date – Demographics/DateOfBirth
Calculated Value	round-half-to-even(10000*BMI/WeightInKg div (BMI/HeightInCm * BMI/HeightInCm),2)
Calculated Value	if (BMI/CalculatedBMI lt 18.5) then 'Underweight' else if (BMI/CalculatedBMI ge 18.5 and BMI/CalculatedBMI lt 25) then 'Healthy' else if (BMI/CalculatedBMI ge 25 and BMI/CalculatedBMI lt 30) then 'Overweight' else 'Obese'
Calculated Value	max(BMI/HeightInCm)
Calculated Value	round-half-to-even(avg(BMI/HeightInCm))
Calculated Value	normalize-space(concat(Demographics/Title, ' ', Demographics/Forename, ' ', Demographics/Surname))
Calculated Value	count(cityEHR:getValues(Fracture/FractureDate,Fracture/CurrentFracture='Yes'))
Calculated Value	cityEHR:instance(patient-instance,cdaheader/id)
Calculated Value	cityEHR:lookup(DrugInformationDirectory,MedicationInformation/DrugName)
Constraint	. gt 0 and . le 100

7. Other Data Properties

Property	Where Used	Description
Hint	Folder View Composition Section Entry Cluster Element Unit CodePoint	Text that is displayed when the user hovers over the component in the user interface.
Alert	Section Entry	Text displayed in a distinctive style with the component. Can be used as a dynamic alert by setting Conditions on the Section or Entry.
Rank	Folder View Composition (except Message)	A string used to sort Folders, Views and Compositions when they are listed for user selection. Sorted in ascending string order. Default value is 1. Messages are not selectable by users and so do not have a Rank.
Precision	Element	The precision (length) of the data value. Used to set the size of the input field in the user interface.

8. Folder

A Folder defines a context of care, such as a clinical specialty or service. The Compositions relevant to that context of care are specified as the content of the Folder.

Property	Description
Identifier	Unique identifier for the ISO-13606 Folder.
DisplayName	Label used when selecting the Folder
Hint	Description displayed when the user hovers over the Folder selection
Rank	Defines the sort order for the list of Folders shown for selection. The highest rank appears at the top of the list. Rank of 0 means it is not displayed for selection
Conditions	Evaluated to determine whether the Folder is in scope, or not.
Content	Selected identifiers of the Compositions this folder – View, Message, Form, Letter, Pathway, Order, Prescription or Booking

9. View

Views are available on the Summary tab of the patient record. There are three types of view: Folder, Composition or Report.

Views are created by query to the longitudinal record of events for the patient.

Property	Description
Identifier	Unique identifier for the ISO-13606 View.
DisplayName	Label used when selecting the View
Hint	Description displayed when the user hovers over the View selection
Rank	Defines the sort order for the list of Views shown for selection. The highest rank appears at the top of the list. Rank of 0 means it is not displayed for selection
ViewType	- Folder - the view retrieves all the Composition(s) listed in the Content - Composition - the view retrieves the Data value for every Element in the Composition listed in the Content - Report - the view generates a report by filling out the InitialValue (usually the calculated Default value) of each Element in the Composition listed in the Content
Content	Set of Compositions for the View, selected from a dropdown menu.

10. Composition

The ISO-13606 Composition has sub-categories in cityEHR as follows:

1. Message
2. Form
3. Letter
4. Pathway
5. Order
6. Prescription
7. Booking

These represent the different ways the Compositions are handled in cityEHR, but generally have the same properties.

Property	Where Used	Description
Identifier	All compositions	Unique identifier for the ISO-13606 Composition.
DisplayName	All compositions	Label used when selecting the Composition
Hint	All compositions	Description displayed when the user hovers over the Composition selection
Rank	All compositions except Message	Defines the sort order for the list of Compositions shown for selection. The highest rank appears at the top of the list. Rank of 0 means it is not displayed for selection
Axis	Form Letter	For alignment of Entry and Element on a Composition • Composition - the same alignment is used for the whole Composition • Section - the best alignment is used for each Section • Entry - the best alignment is used for each Entry
Content	All compositions	List of Sections contained in the Composition. Only Sections with SectionContext corresponding to the type of Composition are available to select as Content. The SectionContext specified for a Section is one of: • Composition - Message, Form or Letter • Pathway • Order • Prescription • Booking If on a Composition sheet there are no Sections available for selection as Content, or the expected Sections are absent, then the most likely cause is that the SectionContext is not correctly specified for the Section on the Section sheet

11. Section

For every Section it is important to specify the SectionContext since this defines the type of Composition in which the Section may be used; if no SectionContext is specified then the Section will not be available for selection in any dropdown menus on the Composition sheets.

If on a Composition sheet there are no Sections available for selection as Content, or the expected Sections are absent, then the most likely cause is that the SectionContext is not correctly specified for the Section.

Property	Description
Identifier	Unique identifier for the ISO-13606 Section.
DisplayName	Label (title) used when the Section is displayed
Hint	Description displayed when the user hovers over the Section
Alert	Text displayed in a distinctive style with the Section. Can be used as a dynamic alert by setting Conditions on the Section..
SectionContext	The context in which this Section can be used: • Composition - Message, Form or Letter • Pathway • Order • Prescription • Booking
Sequence	Determines the layout of Sections or Entries contained in the Section for Compositions. In addition, for Pathway compositions the Sequence determines whether the contained activities (Acts) are to be performed in sequence or in parallel. • Ranked - sequentially, one after the other, laid out vertically • Unranked - concurrently, in parallel, laid out horizontally
Rendition	The way in which the Section is rendered on screen for user interaction • Form - regular interaction using form-based controls (default) • ImageMap - graphical interaction using an image map (which must be loaded through the Administration page) • Image - displayed as a static image (which must be loaded through the Administration page) • Denoted - form-based with each Element preceded by a bullet point icon • Enumerated - form-based with each Element preceded by a number • Standalone - displayed in a pop-out (not yet supported) and printed on a new page • Chart - displayed as a chart generated from historic values of each Element • Highlighted - form-based, emphasized • Hidden - not displayed to the user, but recorded in the record when the Composition is committed

Property	Description
Pre-conditions	Result of the expression is cast to xs:boolean These pre-conditions are evaluated once, when the Composition is loaded; any out-of-scope Section is removed from the Composition before any user interaction begins.
Conditions	The Condition is evaluated continuously as the containing Composition is edited by the user. If the Condition evaluates to true then the Section is in-scope, if the Condition evaluates to false then the Section is out-of-scope. Any out-of-scope Section has its visibility set to false, is hidden from the user, does not get used in other calculations and is removed from the Composition before it is committed to the patient record.
EvaluationContext	Conditions used to constrain the Compositions in the record from which default values for any Elements in the Section are calculated when the Composition is loaded.
Content	Selected identifiers of the content of the Section – can be other Sections (i.e. sub-sections) or Entries. The available selection is determined by the SectionContext – only sections of the same SectionContext, or Entries of the EntryType associated with the SectionContext can be selected as content.

12. Entry

Each Entry must have an EntryType specified, which determines how the ISO 13606 Entry will be represented in HL7 CDA. When Entries are selected as the content of Sections, only the Entries of the EntryType corresponding to the SectionContext of the Section are available for selection.

If an Entry is unexpectedly not available for selection as content for a Section then the most likely cause is the the EntryType and SectionContext do not match.

Property	Description
Identifier	Unique identifier for the ISO-13606 Entry.
DisplayName	Label (title) used when displaying the Entry
Hint	Description displayed when the user hovers over the Entry
Alert	Text displayed in a distinctive style with the Entry. Can be used as a dynamic alert by setting Conditions on the Entry.
Extension	The extension to the Identifier. The purpose of the extension is to allow for specialization of identified Entries. The Entry Identifier is used to define the structure of the health record, but the Extension is used in calculations. This means that the same Entry (same extension) can be defined with different behaviours (specified for Entries with different Identifiers, referring to the same Extension) Selected from the existing Entry Identifiers.. If no Extension is specified for an Entry then it defaults to be the same as the Identifier
Information	An Entry displayed in the Information pane of the user interface that can contain additional information about the Entry to which it is associated. The Information Entry is displayed as Read Only but can include calculations. This could be used (for example) to display a different URL to external information, depending on the values of Elements in the associated Entry.
EntryRelationship	Used to define additional information about an • Encounter - details of the booking • SubstanceAdministration – details of the medication being prescribed • Supply – details of the test being ordered.
Subject	The Composition that is the subject of an Act. Only selectable if the Entry has an EntryType of Act.
EntryType	The HL7 CDA entry type. This determines the SectionContext in which the Entry can be selected. If the EntryType is not set, then the Entry cannot be used, since it won't appear in the drop down selection for the Contents of any Section. The EntryType also determines the HL7 CDA element that is generated. • Observation - used in SectionContext of Composition • Act - used in SectionContext of Pathway • Supply - used in SectionContext of Order

Property	Description
	- SubstanceAdministration - used in SectionContext of Prescription - Encounter - used in SectionContext of Booking
CRUD	How the Entry is instantiated when the Composition is loaded - CRUD - no restriction - Create, Read, Update, Delete - R - Read only. The contents are displayed but the user cannot interact. - CR - Create and Read. New Entries can be added to a multiple entry (as determined by its Occurrence) but and existing pre-filled Entries are read-only. - CRU - Create, Read and Update - CRD - Create, Read and Delete - UL - Lookup in directory and then Update. The complete Entry is retrieved from the Directory of Entries for that identity using the key Element specified in the - L - Lookup in directory (fixed value)
Occurrence	The cardinality of the Entry (one or many) - Single - one instance of the Entry - MultipleEntry - multiple instances of the Entry can be created
InitialValue	How the Entry is instantiated when the Composition is loaded - Empty – all Element values are empty (blank, not set) - Pre-filled – set with the most recent values in the patient record (for both Single and MultipleEntry) - DistinctValues – for MultipleEntry, set with the set of distinct Entries ever recorded - AllValues – for MultipleEntry, set with the set of every Entry ever recorded - Default – the initial value is calculated from the expression in DefaultValue - Transient – set with the most recent values in the patient record for initial calculations, then reset to Empty once the Composition is loaded.
Sequence	Determines the layout of Clusters and Elements contained in the Entry. - Ranked - sequentially, one after the other, laid out vertically - Unranked - concurrently, in parallel, laid out horizontally
SortOrder	For a Multiple Entry only (Occurrence = MultipleEntry) - Ascending - entries are sorted in ascending order (using the SortCriteria Element or the first Element in the Entry, if no SortCriteria) - Descending- entries are sorted in descending order (using the SortCriteria Element or the first Element in the Entry, if no SortCriteria)

Property	Description
SortCriteria	The Element used to sort a MultipleEntry or as the key to look up the value of a directory Entry.
CategorizationCriteria	The Element used to categorize a MultipleEntry. The multiple entries are split into categories – one category for each value of the Element specified as the CategorizationCriteria. This Element must exist as content of the Entry.
Rendition	The way in which the Entry is rendered on screen for user interaction • Form - regular interaction using form-based controls (default) • ImageMap - graphical interaction using an image map (which must be loaded through the Administration page) • Image - displayed as a static image (which must be loaded through the Administration page) • Denoted - form-based with each Element preceded by a bullet point icon • Enumerated - form-based with each Element preceded by a number • Standalone - displayed in a pop-out (not yet supported) and printed on a new page • Chart - displayed as a chart generated from historic values of each Element • Highlighted - form-based, emphasized • Hidden - not displayed to the user, but recorded in the record when the Composition is committed
Scope	For Multiple Entry (Occurrence = MultipleEntry) • Defined - the user may add or remove Entries using the controlsdisplayed • Full – a full (fixed) set of Entries is displayed, one Entry for each value of the first Element in the content of the Entry with type of enumeratedValue, enumeratedClass, calculatedEnumeratedClass or enumeratedDirectory.
CohortSearch	• Searchable - is listed for selection in the Cohort Search page • PrimarySearch - is listed in the primary selection in the Cohort Search page • NotSearchable - is not available for searching in the Cohort Search page
EvaluationContext	Conditions used to constrain the Compositions in the record from which default values for any Elements in the Entry are calculated when the Composition is loaded.
Pre-conditions	Result of the expression is cast to xs:boolean These pre-conditions are evaluated once, when the Composition is loaded; any out-of-scope Entry is removed from the Composition before any user interaction begins.
Conditions	The Condition is evaluated continuously as the containing Composition is edited by the user. If the Condition evaluates to true then the Entry is in-scope, if the

Property	Description
	Condition evaluates to false then the Entry is out-of-scope. Any out-of-scope Entry has its visibility set to false, is hidden from the user, does not get used in other calculations and is removed from the Composition before it is committed to the patient record.
Content	Set of Clusters and Elements contained in the Entry

13. Cluster

Clusters are used to group Elements together and are for layout purposes only. Clusters do not convey any clinical context.

Property	Description
Identifier	Unique identifier for the ISO-13606 Cluster.
DisplayName	Label (title) used when displaying the Cluster
Hint	Description displayed when the user hovers over the Cluster
Sequence	Determines the layout of Elements and Clusters in the Cluster. By default the Sequence of nested Clusters is toggled at each level. • Ranked - sequentially, one after the other, laid out vertically • Unranked - concurrently, in parallel, laid out horizontally
Conditions	The Condition is evaluated continuously as the containing Composition is edited by the user. If the Condition evaluates to true then the Cluster is in-scope, if the Condition evaluates to false then the Cluster is out-of-scope. Any out-of-scope Cluster has its visibility set to false, is hidden from the user, does not get used in other calculations and is removed from the Composition before it is committed to the patient record.
Content	Set of Clusters and Elements contained in the Cluster. Selected from a dropdown menu.

14. Element

ISO 13606 Elements and Data. Each Element is associated with a single Data value which is of the defined DataType and Unit of measurement (if specified). The elementType defines the scope of the Data values, in addition to their base data type.

Property	Description
Identifier	Unique identifier for the ISO-13606 Element.
DisplayName	Label (title) used when displaying the Element
Hint	Description displayed when the user hovers over the Element
Extension	The extension to the Identifier. The purpose of the extension is to allow for specialization of identified Elements. The Element Identifier is used to define the structure of the health record, but the Extension is used in calculations. This means that the same Element (same Extension) can be defined with different behaviours (specified for Elements with different Identifiers, referring to the same Extension) Selected from the existing Element Identifiers.. If no Extension is specified for an Element then it defaults to be the same as the Identifier
ElementType	The type of the element (in addition to the DataType of the Data contained in the element) • simpleType - user control for data entry is based on the DataType • patientMedia - upload control for user to select external media • calculatedValue - value is calculated using the expression in CalculatedValue (not directly editable by the user) • staticValue - a static value calculated from the DefaultValue (then not editable by the user) • enumeratedValue - user selected from one of the values defined for the Element in the Data • enumeratedCalculatedValue - user selected from one of the values defined for the Element from evaluation of the CalculatedValue • enumeratedClass - user selected from one of the values defined in the Class for the Element • enumeratedDirectory - user selected from one of the values defined in the Directory for the Element • memo - for DataType string - displays a larger memo field • range - for DataType integer - displays a range slider between the two values listed in the Data • url - the value (usually a static default value) is displayed as a clickable link • age - set to the current patient age (set as a xs:duration) • icon - displayed as small inline image
DataType	For the value of Data in an Element - these are datatypes from the XML Datatypes

Property	Description
	standard (xs:string, xs:date, etc) • string • date • dateTime • time • duration • dayTimeDuration • yearMonthDuration • double • integer • boolean • anyURI • base64Binary
RequiredValue	• Optional - the Data value can be left blank • Required - the user must fill in the Data value. The Composition can be saved but it cannot be committed to the record unless a value is filled out for the Required Element
Scope	For user selection of the values for an Element with ElementType of enumeratedValue or enumeratedClass • Defined - the user selects from the set of available values, which are not displayed until the user interacts. For enumeratedValue this is a dropdown menu of all defined values. For enumeratedClass this is a button which invokes a dialog box with the classification through which the user can browse and select the required value. • Full - all available values are displayed for selection. For enumeratedValue this is a set of radio button selections, one for each of the defined values. For enumeratedClass this enables the autocomplete so that values are found in the classification as the user types in the input box. If the string types by the user exactly matches one value in the classification then that value is filled out; if a limited number of possible values is returned then a dropdown menu of those values is displayed for the user to select.
Unit	The units of measurement for a data value, selected from the units defined on the Unit sheet.
Precision	The precision (length) of the data value. Used to set the size of the input field in the user interface. When used with a calculatedValue of DataType xs:double the Precision is used to determine the rounding of the value to the specified number of decimal places.
Conditions	The Condition is evaluated continuously as the containing Composition is edited by the user. If the Condition evaluates to true then the Element is in-scope, if the Condition evaluates to false then the Element is out-of-scope. Any out-of-scope Element has its visibility set to false, is hidden from the user, does not get used in other calculations and is removed from the Composition before it is

Property	Description
	committed to the patient record.
Constraints	Result of the expression is cast to xs:boolean An expression that is evaluated as the user enters the value of Data for the Element; if the Constraints evaluates to false then the value entered by the user is removed (replaced by an empty value)
DefaultValue	Expression evaluated to calculate the default data value of the Element. The calculation is performed once, when the Form is loaded.
CalculatedValue	Expression evaluated to calculate the data value of the Element. The calculation is evaluated continuously when the Element is displayed, so that the value may be updated as other values are changed on the Form.
Data	For enumerateValue or calculatedEnumeratedValue the Data specifies pairs of displayName / value for the element. If no value is specified in the pair, then the default value is the same as the displayName. For enumeratedClass the first displayName / value pair defines the class used as the scope for values of the Element. The value is either a single atomic value that defines the classId or is of the form classId:nodeId where the nodeId defines the Identifier of the entry node in the class. If an Element of enumeratedClass is used for CategorizationCriteria then there may be multiple values of the form classId:Nodeid to define the categories.

15. Unit

The unit of measurement that may be assigned to the Data for an Element. Note that Unit is singular. The DisplayName is used to display the unit before or after the field used for the input of the Data (the position of the unit depends on the layout of the form, as defined by the Sequence and Scope of the Entry and/or Element).

Property	Description
Identifier	Unique identifier for the Unit.
DisplayName	Label (title) used when displaying the Unit
Hint	Description displayed when the user hovers over the Unit

16. CodePoint

CodePoints are assigned to Entries in a Composition, either statically or dynamically. Any Composition may have an associated CodePointSet composition which holds all the CodePoints assigned to the Entries in the Composition. The CodePointSet is generated by iterating through the Entries of the Composition and finding any associated CodePoints that have been defined. There may be more than one CodePoint assigned to any individual Entry.

CodePoints are associated with the Entry specified as the Context property. If the CodePoint has Conditions then these are used to determine the dynamic association of the CodePoint with the Entry; if there are no Conditions then the CodePoint is statically assigned.

The CodePointSet is created when the Composition is first committed to the patient record and can be updated by viewing the Event in the record. This means that the CodePointSet is stored as data (dynamic) in the patient record. The CodePointSet may be applied to its associated Composition when the composition is exported from cityEHR; each code is then added as cda:code element to the associated cda:entry.

CodePoints can also be used in Cohort Searches.

Property	Description
Identifier	Unique identifier for the CodePoint.
DisplayName	Label (title) used when displaying the CodePoint
Hint	Description displayed when the user hovers over the Entry
Code	The value of the clinical code assigned to the CodePoint
CodeSystem	The coding system of the Code assigned to the CodePoint. Selected from one of values defined on the Properties sheet: • SNOMED • ICD-10 (can be changed to ICD 11) • LOINC • Additional coding systems can be added to this list
Context	The Entry with which the CodePoint is associated. Since Entry is the lowest context at which actionable clinical information is defined CodePoints can only be assigned at this level. If, for example, CodePoints could be assigned to Elements then the clinical meaning of the Element can change depending on the context of the Entry in which the Element is used, which may render the CodePoint invalid
Conditions	Conditions evaluated in the context of the Entry to which the CodePoint is assigned. If the Conditions evaluate to true then the CodePoint is assigned, if they evaluate to false then it is not assigned.

Appendix 1. Upgrading from Previous Versions

The latest version of the modelling spreadsheet is displayed on the Configuration sheet. The version described in this document is 2025, which has some minor changes from the previous 2018 version.

The best way to update a model to the new version is to copy and paste values from the legacy spreadsheet to the new spreadsheet. Whole columns can be copied at a time (but do not copy the columns headers, since many have changed. Paste using Paste Special | Unformatted text.

Also note that blank values at the start of a column do not get copied, so be careful when copying a whole column that starts with blank fields (in this case find the first non-blank field and start the copy from there).

The table below details the changes that need to be made between the legacy and current models.

Legacy	2025	Comments
Configuration sheet	Configuration sheet	
Application	ApplicationId	
	ModelOwner	New property
Specialty	SpecialtyId	
	SpecialtyDisplayName	New property
	LanguageCode	New property
Legacy	2025	Comments
	Properties sheet	New sheet
	CRUD Occurrence InitialValue DataType EntryType ViewType Rendition ElementType CohortSearch Scope	These properties were previously on the Configuration sheet. Some values may have changed, but the basic function of the property remains the same. No action is necessary on upgrade.

Legacy	2025	Comments
	Sequence RequiredValue Axis	These properties changed name
	ISO-13606 SectionContext SortOrder CodeSystem	These properties are new.
Legacy	2025	Comments
Folders sheet	Folder sheet	Sheet renamed
FolderId	Identifier	Property name changed
	Hint	New property
Contents	Content	Property name changed
Legacy	2025	Comments
Views sheet	View sheet	Sheet renamed
ViewId	Identifier	Property name changed
Contents	Content	Property name changed
Legacy	2025	Comments
Messages sheet	Message sheet	Sheet renamed
MessageId	Identifier	Property name changed
	Hint	New property
Contents	Content	Property name changed

Legacy	2025	Comments
Legacy	2025	Comments
Forms sheet	Form sheet	Sheet renamed
FormId	Identifier	Property name changed
Description	Hint	Property name changed
	Axis	New property
Sections	Content	Property name changed
Legacy	2025	Comments
Letters sheet	Letter sheet	Sheet renamed
LetterId	Identifier	Property name changed
Header		Property removed. The Section in the Header field should be moved to the first Content field
	Axis	New property
Sections	Content	Property name changed
Legacy	2025	Comments
Pathways sheet	Pathway sheet	Sheet renamed
PathwayId	Identifier	Property name changed
	Hint	New property
Sections	Content	Property name changed
Legacy	2025	Comments
	Order sheet	New sheet.
Legacy	2025	Comments

Legacy	2025	Comments
	Prescription sheet	New sheet.
Legacy	2025	Comments
	Booking sheet	New sheet.
Legacy	2025	Comments
Sections sheet	Section sheet	Sheet renamed
SectionId	Identifier	Property name changed
	SectionContext	New property. Mostly will be set to Composition, sometimes to Pathway, since these are the only two types of composition available in the legacy architecture.
Layout	Sequence	Property name changed
	EvaluationContext	New property.
Contents	Content	Property name changed
Legacy	2025	Comments
Sections (Tasks) sheet		Sheet removed. Any sections defined here should be moved to the Section sheet with SectionContext set to Pathway
Legacy	2025	Comments
Entries sheet	Entry sheet	Sheet renamed
EntryId	Identifier	Property name changed
Root Of	Extension	Property name changed
	EntryRelationship	New property

Legacy	2025	Comments
	Subject	New property
Entry Type	EntryType	Property name changed
Initial Value	InitialValue	Property name changed
Layout	Sequence	Property name changed Sequence is just Ranked or Unranked – values for Ascending and Descending are now specified in the new SortOrder property.
	SortOrder	New property Ascending or Descending These were formerly values of the Layout property, so can be transferred from there.
Sort Criteria	SortCriteria	Property name changed
Categorization Criteria	CategorizationCriteria	Property name changed
Scope	Scope	Property values changed Values are now Full or Defined Former value of Expanded should be changed to Full. Former property Hidden should be removed (left blank) and set on the Rendition property instead.
Cohort Search	CohortSearch	Property name changed
	EvaluationContext	New property
Contents	Content	Property name changed
Legacy	2025	Comments
Entries (Actions) sheet		Sheet removed. Any entries defined here should be moved to the Entry sheet with EntryType set to Act
Legacy	2025	Comments

Legacy	2025	Comments
Clusters sheet	Cluster sheet	Sheet renamed
ClusterId	Identifier	Property name changed
Layout	Sequence	Property name changed
Contents	Content	Property name changed
Legacy	2025	Comments
Elements sheet	Element sheet	Sheet renamed
ElementId	Identifier	Property name changed
Root Of	Extension	Property name changed
Element Type	ElementType	Property name changed
Data Type	DataType	Property name changed
Value Required	RequiredValue	Property name changed
Scope	Scope	Property values changed Values are now Full or Defined Former value of Expanded should be changed to Full. Former property Hidden should be removed (left blank) and set the Precision property to 0 (zero) instead.
Units	Unit	Property name changed
Field Length	Precision	Property name changed
Default Value	DefaultValue	Property name changed
Calculated Value	CalculatedValue	Property name changed
Values	Data	Property name changed
Legacy	2025	Comments
Units sheet	Unit sheet	Sheet renamed

Legacy	2025	Comments
UnitId	Identifier	Property name changed
	Hint	New property
Legacy	2025	Comments
	CodePoint sheet	New sheet.

Appendix 2. Ontology Representation

The spreadsheet modelling in cityEHR is used to create the ontology models for clinical specialties and classifications. The ontologies are held in the standard OWL/XML format.