



## ANSI /MEDBIQ VP.10.1-2010 MedBiquitous Virtual Patient Specifications and Description Document



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## 2 Introduction

This document describes a data specification for the exchange and reuse of virtual patients, the ‘MedBiquitous Virtual Patient’ (or MVP) specification. It is intended for use by anyone who wants to create, implement, or create interoperable tools for virtual patients based on this specification. The status of the document is indicated at the bottom of the page; draft documents are subject to review and approval through the *MedBiquitous Consortium Standards Program Operating Procedures* (see [http://www.medbiq.org/working\\_groups/consortium\\_process/MedBiquitousANSIPProcess.pdf](http://www.medbiq.org/working_groups/consortium_process/MedBiquitousANSIPProcess.pdf)).

The objective of this specification is to provide a data structure that allows one to represent a virtual patient activity in a standard format. This document describes the structure of the XML schemas within the MVP specification in detail. A separate *Virtual Patient Player Specifications and Description Document* is a part of this specification and describes the functional requirements for conformant players.

For the purposes of this specification, a virtual patient is defined as:

*An interactive computer simulation of real-life clinical scenarios for the purpose of medical training, education, or assessment. Users may be learners, teachers, or examiners.*

Virtual patients are notoriously difficult and costly to author, adapt and exchange. Historically this has limited their uptake and utility, despite their being able to provide high quality learning opportunities. A standard to enable their exchange across systems has the potential to scale their development and implementation across health professions education, including resource limited settings. Once in a standard format, virtual patients can be exchanged across systems, or exported for stand-alone use with a virtual patient player.

Founded by Johns Hopkins Medicine and leading professional medical societies, the MedBiquitous Consortium is the ANSI-accredited developer of information technology standards for healthcare education and competence assessment. The MVP specification is one component of a broader standards architecture designed to advance healthcare education and competence assessment, thereby improving patient care. For information on other MedBiquitous standards, visit <http://www.medbiq.org>.

### 2.1 General Principles

There are many different ways that virtual patients can be created and employed. The MVP has been designed to be sufficiently abstract and adaptable so that it can accommodate a number of forms and uses.

The MVP architecture consists of five components, including a player functional specification. The data components and models can be accessed and assembled in a number of different ways.

These components may be rendered for use through different kinds of players, depending on the activity at hand and other local choices and requirements. A functional player specification that describes core functionality is part of the MVP architecture. MVP packages may contain a player that conforms to the player specification to enable widespread use of virtual patients. Systems importing virtual patients may ignore the player if they have virtual patient player capabilities. These five along with other related (but out of scope) components are shown in figure 1.

Also note, in order to validate, the elements within the XML files must appear in the same order as they are declared in their respective schema files. This notion of ordering applies to all sets of elements at the same hierarchical level in the XML. In this document, the ordering of elements is shown in the diagrams and tables detailing the schema grammar of the MVP elements.

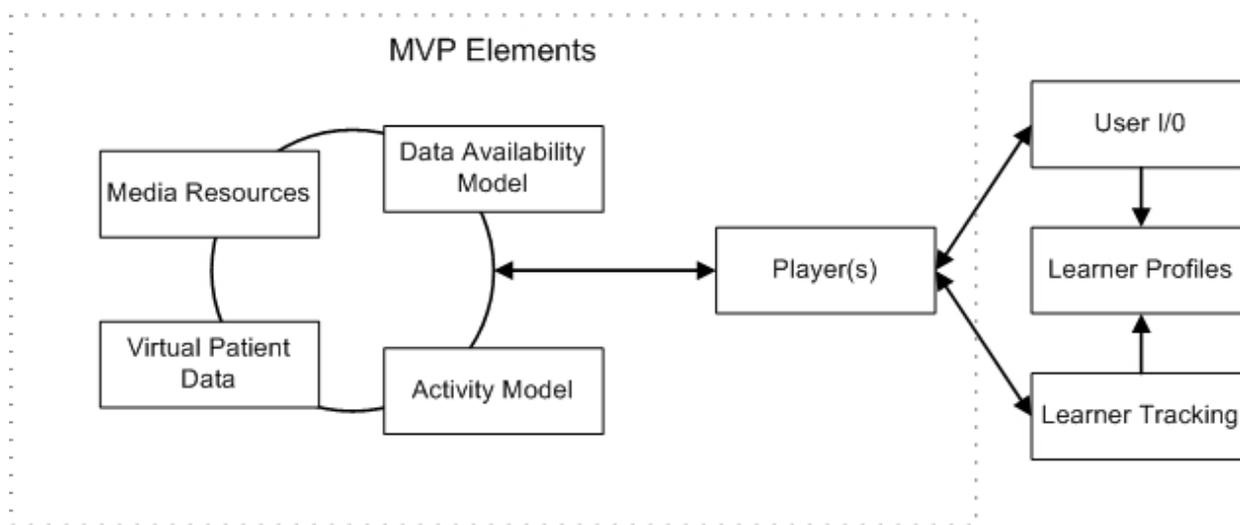


Figure 1: Components of the MVP architecture

## 2.2 MVP Components

There are five core MVP components:

1. **Virtual Patient Data (VPD):**

The VPD provides the personal and clinical data that is relevant to the clinical scenario being simulated. The VPD is a bit like a clinical chart, containing data elements and some structure that corresponds to the medical history, physical examination, laboratory and radiology data, and procedure and outcome data. The VPD architecture has been designed to enable a flexible approach to how this data is expressed and managed.

2. **Media Resources (MR):** Media resources are all of the images, animations, videos, audio files and any other discrete digital objects that are associated with the virtual patient at any point during the simulated patient scenario. As with the specific portions of the VPD data, the media resources are tagged with identifiers so that they can be made available at the right time to the learner. IMS Content Packaging is used to structure media resources within the MVP specification and provide unique identifiers for each media resource.

3. **Data Availability Model (DAM):** This component expresses the aggregation of VPD and MR elements for exposure through the Activity Model. VPD and MR elements can be reused in this context in multiple DAM nodes controlling the way that data aggregations such as patient histories or test results are displayed.
4. **Activity Model (AM):** The AM encodes what the learner can do and how they engage with the virtual patient. By creating available paths through the content using interconnected nodes and controlling how the user can follow them using a simple rule system, a very great variety of virtual patient activities are possible. Note that all content exists either in the VPD or as MR elements; the AM provides the contexts in which they are exposed to the learner.
5. **Virtual Patient Player (VPP) Functional Specification:** The Virtual Patient Player presents the virtual patient to the learner and gathers and parses learner input. The MVP specification includes the MedBiquitous Virtual Patient Player Functional Specification describes the functionality necessary in a conformant player. The player must track which activity model nodes have been visited in the current user session and which VPD elements have been triggered. The full VPP functionality is described in detail in the *Virtual Patient Player Specifications and Description Document*.

In addition to the five MVP components, there are several applications and data sets that are related but external to the MVP standard:

- **Authoring systems:** in addition to players the MVP specification also relates to the systems and tools used to create or edit virtual patients. These tools have a very similar range of required affordances from the specification to those required by players and as such a number of structures (in particular VPD structure) have been incorporated into the specification. In developing the MVP equal attention was given to player and authoring system requirements.
- **External LMS/VLE:** The virtual patient activity is designed to run within a learning management system (LMS) or virtual learning environment (VLE). This may be an LMS or VLE specifically designed to deliver virtual patient activities, The LMS or VLE may track the following types of data:
  - General user information: user identity data (such as their name), as well as their current courses (or program of study), personal user preferences such as choice of language, required disability support features or choice of style sheets, and academic data such as assessment data.
  - Virtual patient usage information: tracking data, records of which virtual patients have previously been accessed (including progress markers) and their relation to study markers such as learning objectives and outcomes. SCORM tracking, assessment metrics etc.

## 2.3 MVP Files and SCORM

The principal purpose of this specification is to allow for the exchange and reuse of virtual patients. To that end the MVP specification also includes the required format and structure for bundling the various components in a virtual patient for exchange. The MVP uses an application profile of a SCORM 2004 4th edition content package, an existing data specification for the exchange of digital resources using the zip file compression format and using a top level XML manifest file to reference as to where and what everything else in the package is. SCORM compliance also allows a virtual patient package to be imported into and run within a SCORM-compliant LMS if a player is present.

Each content package will contain one virtual patient. A virtual patient package consists of the following files, which must appear in the location specified within the content package:

### MVP Files

File	Location	Description
imsmanifest.xml	Root	The manifest lists and organizes the contents of an MVP package, allowing the package to be run by a Learning Management System if a player is present. Further, it enables the mapping of media resource identifiers to media resource file locations.  For more information, see the section Media Resources, the Manifest and SCORM Compliance.
virtualpatientdata.xml	Root	The virtualpatientdata.xml file contains elements that provide clinical and demographic data for a virtual patient as well as metadata.  For more information see the section Virtual Patient Data.
dataavailabilitymodel.xml	Root	The dataavailabilitymodel.xml file contains elements that group virtual patient data and media resources into nodes that allow data to be aggregated and progressively disclosed to the learner.  For more information see the section Data Availability Model.
activitymodel.xml	Root	The activitymodel.xml file contains elements that create

File	Location	Description
		<p>the learning activity for this virtual patient, including the possible paths through the content as well as scoring and timing mechanisms.</p> <p>For more information see the section Activity Model.</p>
Media resource	Root or subdirectory	<p>Media resources are the media files that will be used in the virtual patient. They can be in the root of the package or within sub-directories.</p> <p>For more information see the section Media Resources.</p>
virtualpatientdata.xsd dataavailabilitymodel.xsd activitymodel.xsd	Root	These are XML schemas used to validate the MVP xml files.
SCORM for Healthcare Schemas	Root (unless directory specified in filename)	A valid MVP package must contain all schemas necessary to validate the xml, including SCORM schemas. Note that because there is a requirement for VP packages to run and validate even when not connected to the Internet, all reference schemas must be included with the package rather than reference using a URL that points to a Web schema.
<ul style="list-style-type: none"> <li>• adlcp_v1p3.xsd</li> <li>• imscp_v1p1.xsd</li> <li>• address\address.xsd</li> <li>• common\anyElement.xsd</li> <li>• common\dataTypes.xsd</li> <li>• common\elementTypes.xsd</li> <li>• common\elementNames.xsd</li> <li>• common\rootElement.xsd</li> <li>• common\vocabTypes.xsd</li> <li>• common\vocabValues</li> <li>• extend\custom.xsd</li> <li>• healthcaremetadata.xsd</li> <li>• healthcarevocabularies.xsd</li> <li>• healthcarelom.xsd</li> <li>• unique\strict.xsd</li> <li>• vocab\custom.xsd</li> </ul> <p>For more information on metadata schemas see <i>Healthcare Learning Object Metadata Specifications and</i></p>		

File	Location	Description
<i>Description Document</i>		
Other Schemas	Root	MVP leverages several W3C specifications, including XHTML, XML, and XML Schema. The appropriate xsd and dtd files are included for validation.
<ul style="list-style-type: none"> <li>• xhtml1-strict.xsd</li> <li>• xml.xsd</li> <li>• XMLSchema.dtd</li> <li>• metadata.dtd</li> </ul>		

If the package includes a virtual patient player, the following is also required.

File	Location	Description
html wrapper page	Root	This html file launches the virtual patient activity and communicates with the learning management system if one is available.  For more information, see the <i>MedBiquitous Virtual Patient Player Specifications and Description</i> document.

For more information about the MVP and SCORM, see the section Media Resources, the Manifest, and SCORM Compliance in this document and the *Virtual Patient Player Specifications and Description Document*.

## 2.4 Reference Standards and Specifications

The MVP specification does not sit in isolation from other standards and specifications development work. As the MVP specification was being developed the following were reference points:

- Vocabularies:
  - MeSH (<http://www.nlm.nih.gov/mesh/>)
  - SNOMED (<http://www.snomed.org/>)
  - UMLS (<http://www.nlm.nih.gov/research/umls/>)
- Content management:
  - IMS Content Packaging version 1.2 (<http://www.imsglobal.org/content/packaging>)
  - Healthcare LOM version 1.0 ([http://www.medbiq.org/working\\_groups/learning\\_objects/](http://www.medbiq.org/working_groups/learning_objects/)), an application

profile of the IEEE Learning Object Metadata specification developed by MedBiquitous

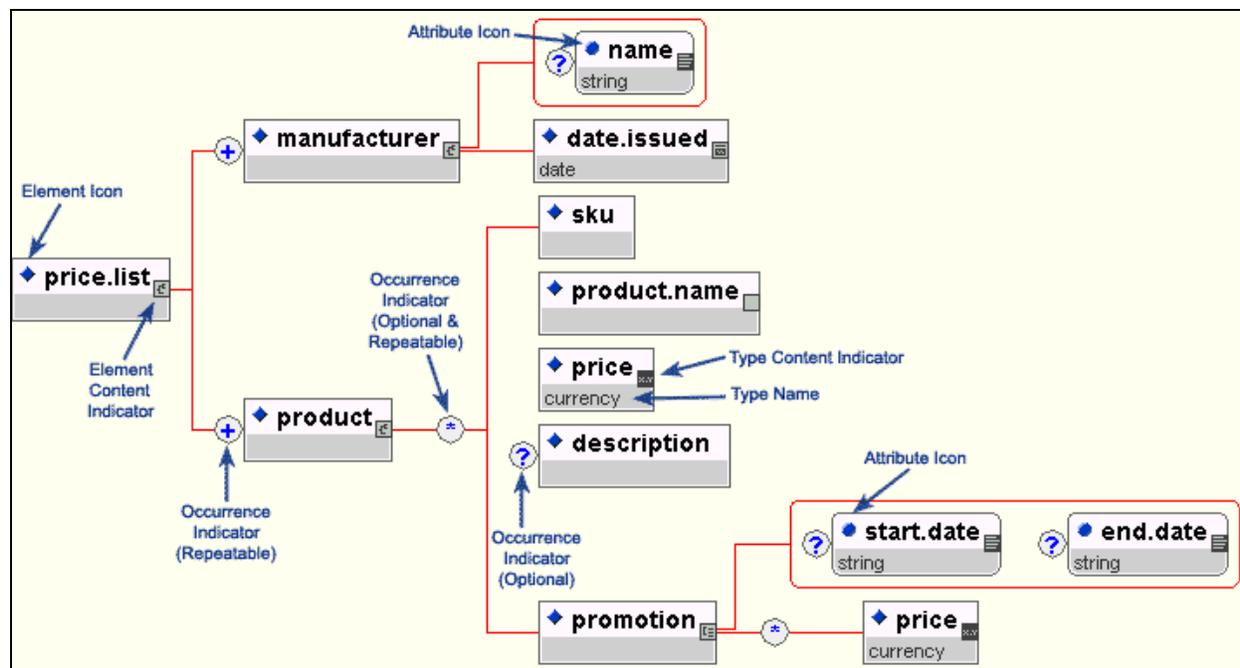
- SCORM 2004 4<sup>th</sup> Edition  
(<http://www.adlnet.gov/Technologies/scorm/SCORMSDocuments/2004%204th%20Edition/Documentation.aspx>)
- Activity representation :
  - IMS Simple Sequencing version 1.0  
(<http://www.imsglobal.org/simplesequencing/index.html>)
  - SCORM 2004 4<sup>th</sup> Edition
  - IMS Learning Design version 1.0 (<http://www.imsglobal.org/learningdesign/>)
- Expression and exchange of clinical data
  - HL7 (<http://www.hl7.org>)
  - Continuity of Care Record (<http://www.astm.org/cgi-bin/SoftCart.exe/COMMIT/COMMITTEE/E31.htm?L+mystore+xaau3131>)
- Abstract data structures
  - eXtensible Topic Maps or XTM (<http://www.topicmaps.org/xtm/>)
  - IMS Vdex version 1.0 (<http://www.imsglobal.org/vdex/index.html>)
  - Zthes (<http://zthes.z3950.org/>)
- The W3C Rule Interchange Format group (<http://www.w3.org/2005/rules/wg>) is looking at common ways of expressing rules although the work is still in its early stages.

### 3 Documentation Conventions

This document uses the following conventions.

Documentation Conventions	
Convention	Description
<code>monospaced type</code>	Sample XML tags, code, schema, or portion thereof
<b>BoldText</b>	When used with an XML tag name, indicates that the element contains sub-elements
<i>Italicized Text</i>	When used in an XML tag description, an attribute of the XML tag.
Tag description	Shading indicated that the tag is further described elsewhere in the document

The following graphical standards are used for the XML diagrams in this document.



**Figure 2:** Graphical Standards from TIBCO's Turbo XML, Copyright TIBCO Software Inc. *Graphical Standards from TIBCO's Turbo XML, Copyright TIBCO Software Inc.*

The ordering of elements at one hierarchical level in the diagram above represents the ordering of elements as declared in the schema file. This ordering is important because, in order to validate, elements in the instance file (XML file that implements the schema) need to have the same ordering. In the context of the example above, the XML element 'manufacturer' must appear before the 'product' element in the XML file. Similarly, within the product element, the 'price' element must appear before the 'description' element, and so forth.

## 4 Identifying Data and Resources through XPath

XPath is a language for finding information in an XML document. XPath is used to navigate through elements and attributes in an XML document. It is a W3C Standard.

The MedBiquitous Virtual Patient specification uses XPath to point to MVP data and resources across XML documents.

XPath expressions use the following construction:

`/SomeElement/SomeSubElement.....` Selects all SomeSubElements that are sub-elements of SomeElement.

`/SomeElement/SomeSubElement[@test = 'x'].....` Selects all SomeSubElements that have an attribute named test with a value of 'x' that are sub-elements of SomeElement.

`/SomeElement/SomeSubElement/text().....` Selects all element content (text) in all SomeSubElements that are sub-elements of SomeElement.

Example 1:

```
.....
<ActivityNode id="3" label="Interview Patient">
  <Content>
    /DataAvailabilityModel/DAMNode[@id = '321']
  </Content>
</ActivityNode>
.....
```

This references DAMNode with id 321. DAMNodes are located inside the element DataAvailabilityModel, hence the syntax.

**Example 2:**

```
<DAMNode id="21">
  <DAMNodeLabel>
    Interview Questions Container
  </DAMNodeLabel>
  ...
  <DAMNodeItem display="ontrigger">
    <ItemPath>
      /VirtualPatientData/InterviewItem[@id = '6']
    </ItemPath>
    <ItemComment>
      /DataAvailabilityModel/DAMNode[@id = '425']
    </ItemComment>
  </DAMNodeItem>
  ...
</DAMNode>
```

The ItemPath in the DAMNodeItem references an element in VirtualPatientData. ItemComment contains a reference to another DAMNode (used to provide feedback and/or new information if needed).

Individual pieces of data (rather than containers) may be referenced as well, as in the following example. This will give the name of the patient in question. In this case, the Name element does not have an id associated with it but, because it only occurs once in the VPD, it can be referenced without ambiguity. The same goes with any other data element that only exists once within the VPD.

**Example 3:**

```
/VirtualPatientData/PatientDemographics/CoreDemographics/Name/text()
```

To reference non-repeating elements found inside repeating elements, ids can be combined with the notation above. An example of this is medication. There can be many medication elements, but in each medication element only one medication name exists.

**Example 4:**

```
/VirtualPatientData/Medication[@id = '242']/MedicationName/text()
```

This will give the name of the medication with id 242.

The Virtual Patient Player should determine which component (AM, DAM, VPD) of the architecture is being referenced by examining the first token of the XPath string.

## 5 Virtual Patient Data

### 5.1 *Virtual Patient Data Principles and Data Elements*

The VPD contains all of the granular textual content of a virtual patient, including all of its narrative, clinical data and patient interactions. Structurally the VPD separates out all of the elements from the way these elements are arranged relative to one another.

The Virtual Patient Data schema includes the following data elements. In most cases, these elements contain subelements.

1. VirtualPatientData
2. PatientDemographics
3. VPDText
4. Medication
5. InterviewItem
6. PhysicalExam
7. DiagnosticTest
8. Diagnosis
9. Intervention
10. Organization
11. XtensibleInfo

The root element is VirtualPatientData.

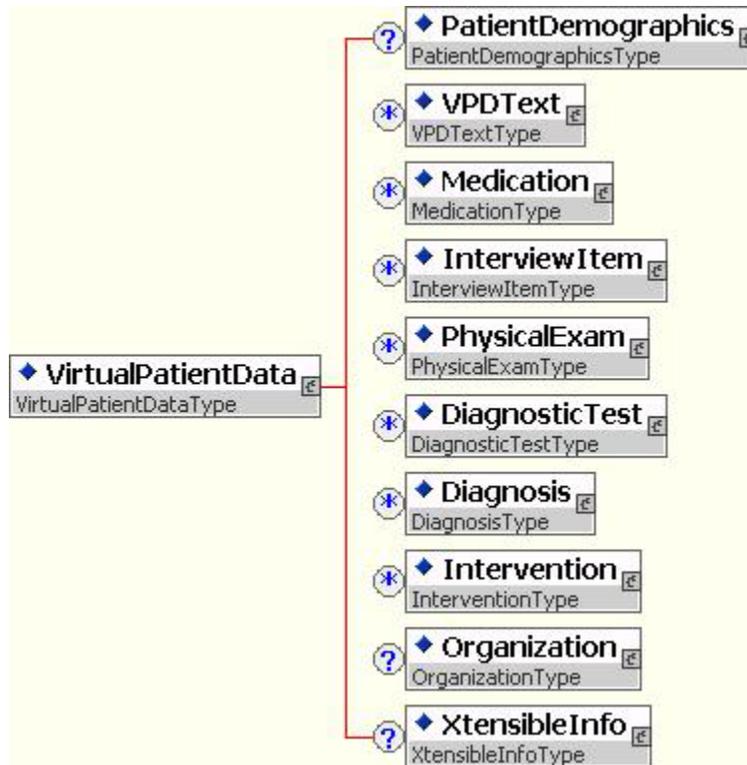
### 5.2 *Virtual Patient Data Schema Grammar*

The following sections explain the Virtual Patient Data Schema grammar. Values in bold under XML Tags column indicate that the element has sub-elements.

All the elements having sub-elements will be defined in separate sections. All elements without sub-elements will be defined within the appropriate element sections that use them.

#### 5.2.1 **VirtualPatientData**

VirtualPatientData is the root element. It contains elements that provide clinical and demographic data for a virtual patient as well as metadata. VirtualPatientData must occur once and only once within a VirtualPatientData instance document.



VirtualPatientData has the following elements.

#### VirtualPatientData Element Information

Element	Description	Required	Multiplicity	Datatype
<b>VirtualPatientData</b>	VirtualPatientData is the root element. It contains elements that provide clinical and demographic data for a virtual patient as well as metadata.	Required	1	Container
<b>PatientDemographics</b>	PatientDemographics is the subelement of VirtualPatientData. It contains subelements that define the name, age, sex, and other demographic characteristics of a virtual patient. See section PatientDemographics for more information.	Optional	0 or 1	Container

<b>Element</b>	<b>Description</b>	<b>Required</b>	<b>Multiplicity</b>	<b>Datatype</b>
<b>VPDText</b>	VPDText is the subelement of VirtualPatientData that provides narrative or other descriptive text that is part of the virtual patient data.	Optional	0 or more	Container
<b>Medication</b>	Medication is a subelement of VirtualPatientData and describes a medication taken by the virtual patient in detail. See section Medication for more details.	Optional	0 or more	Container
<b>InterviewItem</b>	InterviewItem is a subelement of VirtualPatientData. It contains subelements that describe a single question and response. See section InterviewItem for more information.	Optional	0 or more	Container
<b>PhysicalExam</b>	PhysicalExam is the subelement of VirtualPatientData. It contains subelements that describe a single physical exam and the findings of that exam. See section PhysicalExam for more information.	Optional	0 or more	Container
<b>DiagnosticTest</b>	DiagnosticTest is the subelement of VirtualPatientData and contains subelements that define test results. See section DiagnosticTest for more information.	Optional	0 or more	Container

<b>Element</b>	<b>Description</b>	<b>Required</b>	<b>Multiplicity</b>	<b>Datatype</b>
<b>Diagnosis</b>	DifferentialDiagnosis is the subelement of VirtualPatientData that defines either a differential diagnosis or an author diagnosis meant to be the final diagnoses intended by the virtual patient author. See section DifferentialDiagnosis for more information.	Optional	0 or more	Container
<b>Intervention</b>	Intervention is the subelement of VirtualPatientData and describes a single intervention. See section Intervention for more information.	Optional	0 or more	Container
Organization	Organization is the subelement of VirtualPatientData. Organizations contains subelements that create a hierarchical structure for the other virtual patient data elements. This hierarchy can then be used by authoring systems importing the data. See section Organization for more information.	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
<b>XtensibleInfo</b>	<p>The XtensibleInfo is a subelement of VirtualPatientData. It contains sub-elements defined by the organization implementing the schema. It extends the currently defined schema.</p> <p>Virtual Patient decision path should not be dependent on data within XtensibleInfo as many systems will not be able to use this data.</p> <p>Elements listed in XtensibleInfo may be candidates for inclusion in a revision of the MedBiquitous Virtual Patient Specification. We encourage submission of these ideas to the MedBiquitous Virtual Patient Working Group.</p> <p>See XtensibleInfo section for more information.</p>	Optional	0 or 1	Container

**Example:**

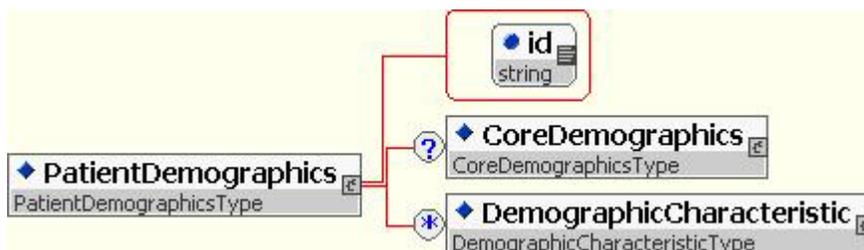
```

<VirtualPatientData>
  <PatientDemographics> ... </PatientDemographics>
  <VPDText> ... </VPDText>
  <Medication> ... </Medication>
  <InterviewItem> ... </InterviewItem>
  <PhysicalExam> ... </PhysicalExam>
  <DiagnosticTest> ... </DiagnosticTest>
  <DifferentialDiagnosis> ... </DifferentialDiagnosis>
  <Intervention> ... </Intervention>
  <Organization> ... </Organization>
  <XtensibleInfo> ... </XtensibleInfo>
</VirtualPatientData>

```

## 5.2.2 PatientDemographics

The PatientDemographics element contains subelements that define the name, age, sex, and other demographic characteristics of a virtual patient and allows for the categorization or grouping of various demographic characteristics.



### PatientDemographics Element Information

Element	Description	Required	Multiplicity	Datatype
<b>PatientDemographics</b>	<p>PatientDemographics is the subelement of VirtualPatientData. It contains subelements that define the name, age, sex, and other demographic characteristics of a virtual patient.</p> <p>PatientDemographics has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p>	Optional	0 or 1	Container
<b>CoreDemographics</b>	<p>CoreDemographics is the subelement of PatientDemographics. It contains subelements that define key characteristics of the virtual patient, including name, age, sex, etc. See section CoreDemographics for more information.</p>	Optional	0 or 1	Container

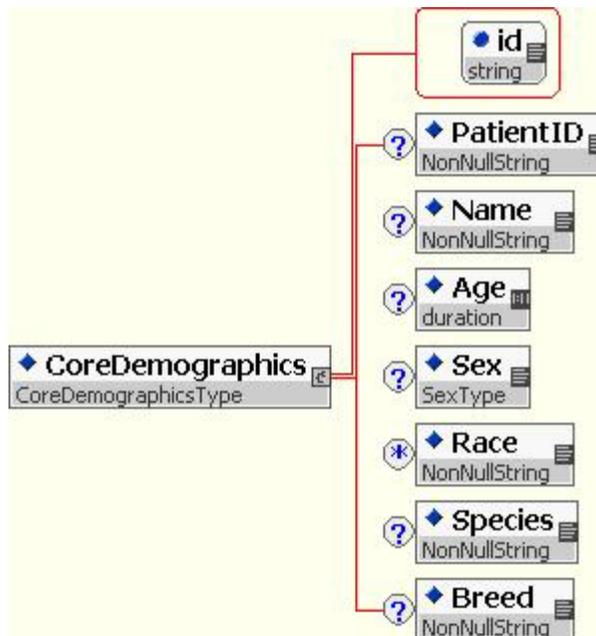
Element	Description	Required	Multiplicity	Datatype
<b>DemographicCharacteristic</b>	DemographicCharacteristic is the subelement of PatientDemographics. It contains subelements that define a specific demographic characteristic. See section DemographicsCharacteristic for more information.	Optional	0 or more	Container

Example:

```
<PatientDemographics id="DR313">
  <CoreDemographics> ... </CoreDemographics>
  <DemographicsCharacteristic> ... </DemographicsCharacteristic>
</PatientDemographics>
```

### 5.2.2.1 CoreDemographics

CoreDemographics defines key characteristics of the human or animal virtual patient, including name, id, age, sex, race, species and breed.



## CoreDemographics Element Information

Element	Description	Required	Multiplicity	Datatype
CoreDemographics	<p>CoreDemographics is the subelement of PatientDemographics. It contains subelements that define key characteristics of the virtual patient, including name, age, sex, etc.</p> <p>CoreDemographics has the following attribute:</p> <p><i>id</i></p> <p>A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p>	Optional	0 or 1	Container
PatientID	<p>PatientID is the subelement of PatientDemographicsCategory. It is an identifier for the virtual patient, similar to the patient ID that would be used to track a patient within a hospital.</p>	Optional	0 or 1	Non-null String
Name	<p>Name is the subelement of PatientDemographicsCategory and defines the full name of the virtual patient. For example, John Smith.</p>	Optional	0 or 1	Non-null String
Age	<p>Age is the subelement of PatientDemographicsCategory and defines the age of a virtual patient as a time duration. For example, 15 years 6 months would be represented as:</p> <p>P15Y6M</p> <p>One day and two hours would be represented as:</p> <p>P1DT2H</p> <p>For more information on duration see: <i>XML Schema Part 2: Datatypes Second Edition document</i></p>	Optional	0 or 1	Duration

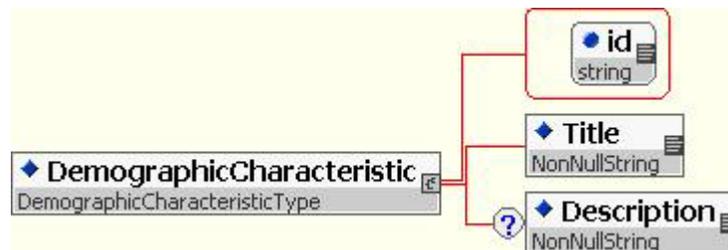
Element	Description	Required	Multiplicity	Datatype
Sex	Sex is the subelement of PatientDemographicsCategory and defines the sex of the virtual patient. Valid values are: Male, Female, and Indeterminate.	Optional	0 or 1	Restricted
Race	Race is the subelement of PatientDemographicsCategory and defines a population group or classification usually based on physical characteristics.	Optional	0 or more	Non-null String
Species	Species is the subelement of PatientDemographicsCategory and defines the biological classification or genus subdivision for the virtual patient. For example, Felis catus.	Optional	0 or 1	Non-null String
Breed	Breed is the subelement of PatientDemographicsCategory and defines the species subgroup for the virtual patient. For example, Standard Poodle.	Optional	0 or 1	Non-null String

### Example:

```
<CoreDemographics id="D123">
  <PatientID> P43224 </PatientID>
  <Name> John Smith </Name>
  <Age> P54Y </Age>
  <Sex> Male </Sex>
  <Race> Caucasian </Race>
</CoreDemographics>
```

### 5.2.2.2 DemographicCharacteristic

DemographicCharacteristic defines the title and description of a demographic characteristic for this virtual patient.



## DemographicCharacteristic Element Information

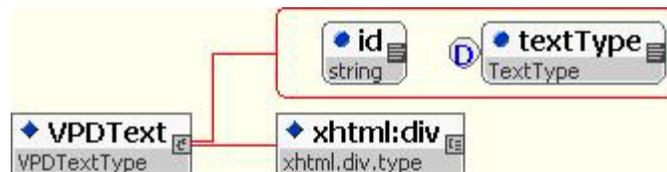
Element	Description	Required	Multiplicity	Datatype
<b>DemographicCharacteristic</b>	DemographicCharacteristic is the subelement of PatientDemographics. It contains subelements that define a specific demographic characteristic. DemographicCharacteristic has the following attribute:  <i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.	Optional	0 or more	Container
Title	Title is the subelement of DemographicCharacteristic and defines the title of the demographic characteristic. For example, marital status.	Required	1	Non-null String
Description	Description is the subelement of DemographicCharacteristic and describes the demographic characteristic in more detail.	Optional	0 or 1	Non-null String

Example:

```
<DemographicCharacteristic id="H32B3">
  <Title> Marital Status </Title>
  <Description> Divorced </Description>
</DemographicCharacteristic>
```

### 5.2.3 VPDText

VPDText is the subelement of VirtualPatientData that provides narrative or other descriptive text that is part of the virtual patient data.



## VPDText Element Information

Element	Description	Required	Multiplicity	Datatype
<b>VPD Text</b>	<p>VPDText is the subelement of VirtualPatientData that provides narrative or other descriptive text that is part of the virtual patient data.</p> <p>VPDText contains an xhtml div element that can be used to format how text will be presented to the user.</p> <p>VPDText has the following attributes:</p> <p><i>id</i> A unique identifier for this text that can be used by other virtual patient components to control how the text is used in an educational activity. The id attribute is required.</p> <p><i>textType</i> An indicator of the function this text serves in the virtual patient. Valid values are: chief complaint, history, problem, allergy, narrative. Narrative is the default value.</p>	Optional	0 or more	Container
xhtml:div	<p>xhtml:div is a subelement of VPDText. MVP uses an extended version of XHTML that provides a mechanism for referencing media using XPath references to the manifest. A div element is a mixed type element referenced from XHTML. The div element can include a mix of text, XHTML tags as specified by the XHTML schema, and media references. This markup allows text within VPDText to have specific formatting. See the section media for more information on media references in the extended XHTML.</p> <p>Although the div can contain many different tags, and is</p>	Required	1	div For XHTML 1.0 Specification, see <a href="http://www.w3.org/TR/xhtml1/">http://www.w3.org/TR/xhtml1/</a>

Element	Description	Required	Multiplicity	Datatype
	<p>conformant to the XHTML standard, the MVP limits markup. See the table that follows for a list of tags players will be required to support.</p> <p>Note: the img tag cannot reference any media resource that is not in the virtual patient package. In other words, all media references from img tags must be local and point to resources within the package.</p> <p>Also, the use of Javascript is not allowed in the XHTML comprising VPDText. Authoring systems and players are not mandated to support any javascript function or calls made from within the VPDText element.</p> <p>The XHTML namespace of the div element must be declared in the instance document. The namespace of XHTML is:</p> <p><a href="http://www.w3.org/1999/xhtml">http://www.w3.org/1999/xhtml</a></p> <p>The instance document must also point to the extended XHTML schema, vpd-xhtml.xsd, using the schemaLocation attribute.</p>			

---

The following tags may be used within the div tag.

## XHTML Tags Permitted

Tag Use	Tag	Attributes
Bullet List	ul, li, ol	none
Headers	h1, h2, h3, h4, h5	none
Image	img	alt, src,
Line Break	br	none
Link	a	href,
Paragraph	p	none
Subscript/Superscript	sub, sup	none
Table	table, tbody, tr, td, th	border
strong emphasis	strong	none
emphasis	em	none
Division/section	div	class
Media	media	See section media

## Example:

```

<VPDText id="t4" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml" >
    A 30 year-old woman who is four months' pregnant presents to your
    gastroenterology office for the first time with a chief complaint of
    <strong>bloody diarrhea.</strong><br/>
  </div>
</VPDText>

```

## 5.2.3.1 media

The media extension to XHTML provides a mechanism for referencing media using XPath references to the manifest.

## media Element Information

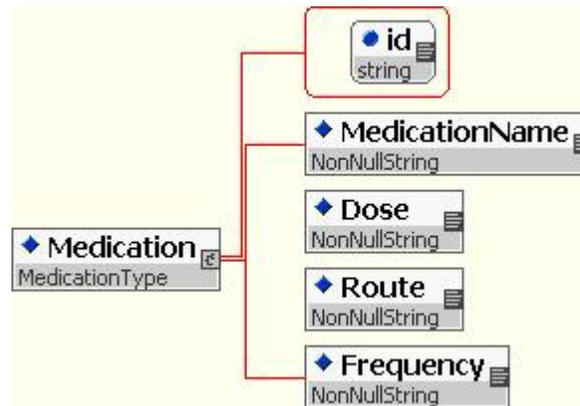
Element	Description	Required	Multiplicity	Datatype
<b>media</b>	<p>media is a subelement of the extended XHTML div element. media provides a reference to media referenced in the virtual patient package as well as alternate text that can be displayed in the event that the player does not support XHTML extensions.</p> <p>media has the following attributes:</p> <p><i>refPath</i> provides an XPath which points to a media resource in the manifest. refPath is a required attribute. See section Identifying Data and Resources through XPath for more information.</p> <p><i>width</i> a non-negative integer indicating the width of the media object in pixels.</p> <p><i>height</i> a non-negative integer indicating the height of the media object in pixels.</p> <p><i>align</i> the horizontal alignment of the media object. Valid values are: left, right, center</p>	Optional	0 or more	Container
Any allowed XHTML element	The media element may have any allowed XHTML element as a subelement. The subelements provide content that will display in the event the media referenced in the media refPath attribute cannot be displayed.	Optional	0 or more	See section VPDText for a table of allowed XHTML elements and attributes.

### 5.2.3.2 Referencing Images in div

The div element has the ability to contain XHTML markup including the img tag. This tag has the ability to reference images directly without referencing the resource id established in the manifest. Any media resource referenced directly by the div element will not be tracked by the Virtual Patient Player. Alternately, the media resource may be referenced in the Data Availability Model.

### 5.2.4 Medication

Medication describes a medication taken by the virtual patient in detail, including the medication name, dose, route, and frequency.



## Medication Element Information

Element	Description	Required	Multiplicity	Datatype
<b>Medication</b>	<p>Medication is a subelement of VirtualPatientData and describes a medication taken by the virtual patient in detail.</p> <p>Medication has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p>	Optional	0 or more	Container
MedicationName	<p>MedicationName is a subelement of Medication and defines the name of the medication, possibly referencing a medical taxonomy or vocabulary.</p> <p>MedicationName has the following attributes.</p> <p><i>source</i> The taxonomy or vocabulary serving as the source of the problem name.</p> <p><i>sourceid</i> the unique identifier assigned to this taxonomic reference within the taxonomy or vocabulary.</p>	Required	1	Non-null String
Dose	<p>Dose is a subelement of Medication and defines the dosage of the medication. For example, 10 mg.</p>	Required	1	Non-null String
Route	<p>Route is a subelement of Medication and defines the route of administration for the medication. For example, oral.</p>	Required	1	Non-null String

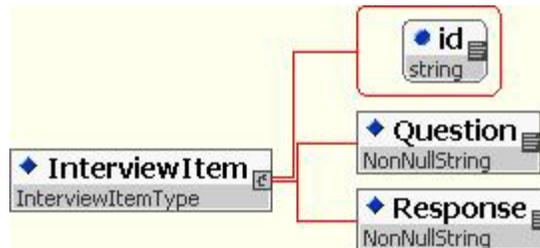
Element	Description	Required	Multiplicity	Datatype
Frequency	Frequency is a subelement of Medication and defines the frequency of administration of the medication. For example, daily.	Required	1	Non-null String

Example:

```
<Medication id="5">
  <MedicationName>aspirin</MedicationName>
  <Dose>12mg</Dose>
  <Route>orally</Route>
  <Frequency>every 3 hours</Frequency>
</Medication>
```

### 5.2.5 InterviewItem

InterviewItem contains subelements that describe a single question and response that is part of a clinical history.



## InterviewItem Element Information

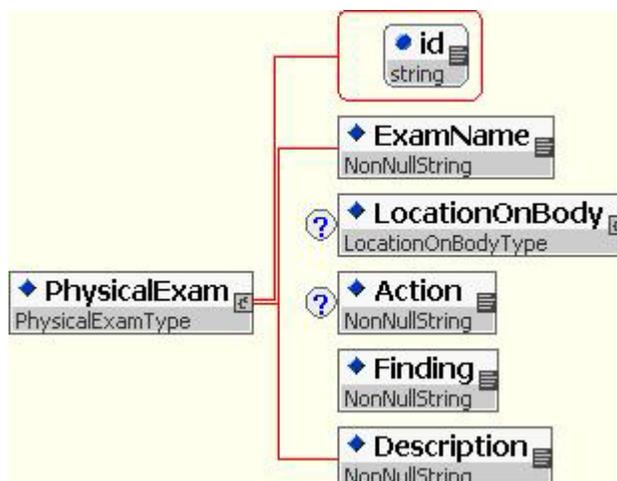
Element	Description	Required	Multiplicity	Datatype
InterviewItem	<p>InterviewItem is a subelement of VirtualPatientData. It contains subelements that describe a single question and response.</p> <p>InterviewItem has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p>	Optional	0 or more	Container
Question	<p>Question is a subelement of InterviewItem. It contains the interview question that the learner may ask the virtual patient.</p>	Required	1	Non-null String
Response	<p>Response is a subelement of InterviewItem. It contains the virtual patient's response to the interview question.</p>	Required	1	Non-null String

## Example:

```
<InterviewItem id="2">
  <Question>How are you feeling?</Question>
  <Response>Not very well.</Response>
</InterviewItem>
```

## 5.2.6 PhysicalExam

PhysicalExam describes a single physical exam and the findings of that exam.



### PhysicalExam Element Information

Element	Description	Required	Multiplicity	Datatype
<b>PhysicalExam</b>	PhysicalExam is the subelement of VirtualPatientData and describes a single physical exam and the findings of that exam.  PhysicalExam has the following attribute:  <i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.	Optional	0 or more	Container
<b>ExamName</b>	ExamName is the subelement of PhysicalExam and defines the name of the exam.	Required	1	Non-null String
<b>LocationOnBody</b>	LocationOnBody is the subelement of PhysicalExam and contains subelements that define the body location of the physical exam. See section LocationOnBody for more information.	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
Action	Action is the subelement of PhysicalExam and defines the action the virtual clinician takes to perform the exam. For example, palpate.	Optional	0 or 1	Non-null String
Finding	Finding is the subelement of PhysicalExam and defines the findings of the exam. For example, normal heartbeat.	Required	1	Non-null String
Description	Description is the subelement of PhysicalExam and describes the exam in more detail.	Required	1	Non-null String

Example:

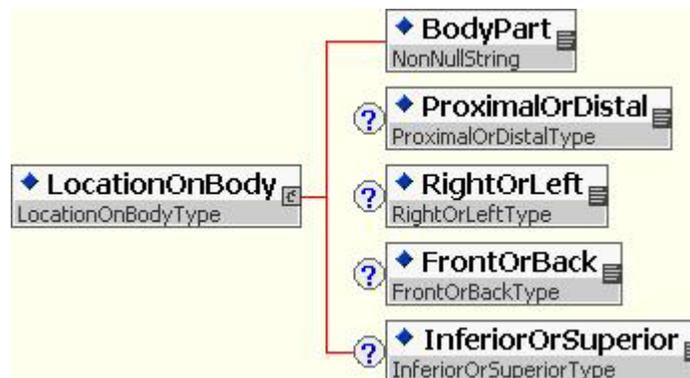
```

<PhysicalExam id="3">
  <ExamName>blood pressure</ExamName>
  <LocationOnBody>
    ...
  </LocationOnBody >
  <Action>use sphygnomanometer</Action>
  <Finding>120/90</Finding>
  <Description>systolic=120mmHg,diastolic=90mmHg</Description>
</PhysicalExam>

```

### 5.2.6.1 LocationOnBody

LocationOnBody contains subelements that define the precise body location of the physical exam.



## LocationOnBody Element Information

Element	Description	Required	Multiplicity	Datatype
LocationOnBody	<p>LocationOnBody is the subelement of PhysicalExam and contains subelements that define the body location of the physical exam.</p> <p>LocationOnBody has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity.</p>	Optional	0 or 1	Container
BodyPart	<p>BodyPart is the subelement of LocationOnBody that describes the body part, such as arm, that is the location of the physical exam.</p> <p>BodyPart has the following attributes:</p> <p><i>source</i> The taxonomy or vocabulary serving as the source of the body part.</p> <p><i>sourceid</i> The unique identifier assigned to this taxonomic reference within the taxonomy or vocabulary.</p>	Required	1	Non-null String
ProximalOrDistal	<p>ProximalOrDistal is the subelement of LocationOnBody that describes body part's location in reference to the center of the body. Valid values are Proximal and Distal.</p>	Optional	0 or 1	Restricted

Element	Description	Required	Multiplicity	Datatype
RightOrLeft	RightOrLeft is the subelement of LocationOnBody that describes the side of the body part's location. Valid values are Right and Left.	Optional	0 or 1	Restricted
FrontOrBack	FrontOrBack is the subelement of LocationOnBody that identifies the facing direction of the body location. Valid values are Front and Back.	Optional	0 or 1	Restricted
InferiorOrSuperior	InferiorOrSuperior is the subelement of LocationOnBody that identifies whether the body location is toward the feet or head. Valid values are Inferior and Superior.	Optional	0 or 1	Restricted

**Example:**

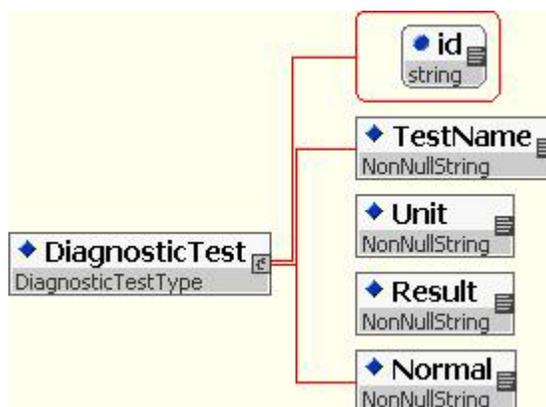
```

<LocationOnBody>
  <BodyPart> Femur </BodyPart>
  <ProximalOrDistal> Distal </ProximalOrDistal>
  <FrontOrBack> Front </FrontOrBack>
</LocationOnBody>

```

**5.2.7 DiagnosticTest**

DiagnosticTest contains subelements that define test results in detail.



## DiagnosticTest Element Information

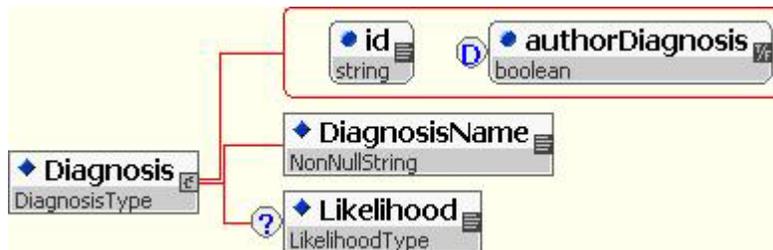
Element	Description	Required	Multiplicity	Datatype
<b>DiagnosticTest</b>	<p>DiagnosticTest is the subelement of VirtualPatientData and contains subelements that define test results.</p> <p>DiagnosticTest has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p>	Optional	0 or more	Container
TestName	TestName is the subelement of Test and defines the name of the test.	Required	1	Non-null String
Unit	Unit is the subelement of Test and defines the unit of measure for the test.	Required	1	Non-null String
Result	Result is the subelement of Test and defines the results of the test.	Required	1	Non-null String
Normal	Normal is the subelement of Test and defines the normal range for the defined test.	Required	1	Non-null String

**Example:**

```
<DiagnosticTest id="4">
  <TestName> WBC (white blood cell count)</TestName>
  <Unit>count</unit>
  <Result>11.4</Result>
  <Normal>10</Normal>
</DiagnosticTest>
```

## 5.2.8 Diagnosis

Diagnosis is the subelement of VirtualPatientData that defines a single differential or author diagnosis.



## Diagnosis Element Information

Element	Description	Required	Multiplicity	Datatype
<b>Diagnosis</b>	<p>Diagnosis is the subelement of VirtualPatientData that defines either a single differential diagnosis or a single final diagnosis intended by the virtual patient author.</p> <p>Diagnosis has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p> <p><i>authorDiagnosis</i> Defines whether or not the diagnosis is specified by the author as an appropriate final diagnosis.</p> <p>This attribute is restricted to the following values: true or false. False is the default value.</p>	Optional	0 or more	Container
DiagnosisName	<p>DiagnosisName is the subelement of Diagnosis and defines the name of the diagnosis.</p> <p>DiagnosisName has the following attributes.</p> <p><i>source</i> The taxonomy or vocabulary serving as the source of the diagnosis name.</p> <p><i>sourceid</i> the unique identifier assigned to this taxonomic reference within the taxonomy or vocabulary.</p>	Required	1	Non-null String

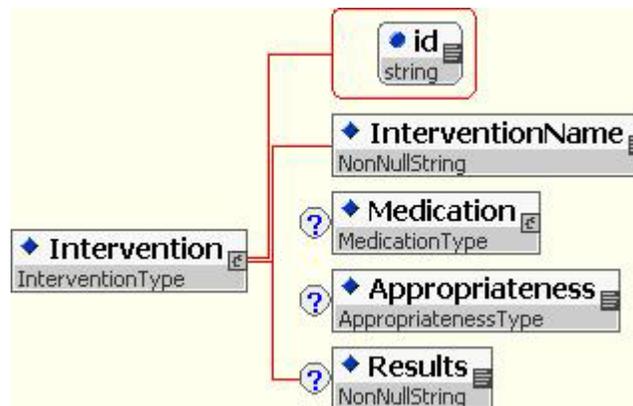
Element	Description	Required	Multiplicity	Datatype
Likelihood	Likelihood is the subelement of DifferentialDiagnosis that defines the likelihood of the differential diagnosis being correct. Valid values are: high, medium, low, none.	Optional	0 or 1	Restricted

Example:

```
<Diagnosis id="6" authorDiagnosis="false">
  <DiagnosisName>myocardial infarction</DiagnosisName>
  <Likelihood>high</Likelihood>
</Diagnosis>
```

## 5.2.9 Intervention

Intervention contains subelements that describe a single intervention.



## Intervention Element Information

Element	Description	Required	Multiplicity	Datatype
<b>Intervention</b>	<p>Intervention is the subelement of VirtualPatientData and contains subelements that describe a single intervention.</p> <p>Intervention has the following attribute:</p> <p><i>id</i> A unique identifier for this set of data that can be used by other virtual patient components to control how this set of data is used in an educational activity. The id attribute is required.</p>	Optional	0 or more	Container
InterventionName	InterventionName is the subelement of Intervention and defines the name of the intervention, for example, appendectomy.	Required	1	Non-null String
<b>Medication</b>	Medication is the subelement of Intervention and describes a medication used as an intervention. For more information, see section Medication.	Optional	0 or 1	Container
Appropriateness	Appropriateness is the subelement of Intervention that defines the appropriateness of the differential diagnosis. Valid values are: always, ok, never, none.	Optional	0 or 1	Restricted
Results	Results is the subelement of Intervention that describes the results of the intervention.	Optional	0 or 1	Non-null String

**Example:**

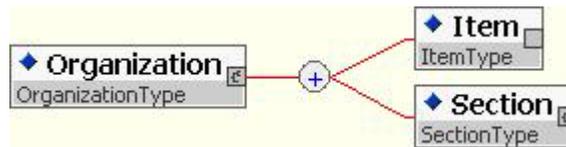
```

<Intervention id="7">
  <InterventionName>
    Administration of atenolol
  </InterventionName>
  <Medication ID="56">
    ...
  </Medication>
  <Appropriateness>never</Appropriateness>
  <Results>
    25 minutes after administration of atenolol Mr Mackintosh becomes
    much worse with increasing breathlessness, HR 88 sinus rhythm, BP
    85/45. This was a bad idea!
  </Results>
</Intervention>

```

**5.2.10 Organization**

Organization is the subelement of VirtualPatientData. Organizations contains subelements that create a hierarchical structure for other virtual patient data elements. This hierarchy can then be used by authoring systems importing the data.

**Organization Element Information**

Element	Description	Required	Multiplicity	Datatype
<b>Organization</b>	Organization is the subelement of VirtualPatientData. Organizations contains subelements that create a hierarchical structure for other virtual patient data elements. This hierarchy can then be used by authoring systems importing the data.	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
Item	<p>Item is the subelement of Organization. Item points to a single piece of data. Item indicates the unique id of a single virtual patient data element within this dataset. Item is a leaf within the hierarchical structure.</p> <p>Item has the following attributes:</p> <p><i>idRef</i> The unique identifier of the data within this dataset. The idRef attribute is required.</p> <p><i>label</i> A label for this piece of data, such as Chief Complaint.</p> <p><i>source</i> The taxonomy or vocabulary serving as the source of a description of this item.</p> <p><i>sourceID</i> The unique identifier assigned to this taxonomic reference within the taxonomy or vocabulary.</p>	Either Item or Section is required	1 or more	Empty
Section	<p>Section is the subelement of Organization that aggregates data items into meaningful groups. Section is a branch within the hierarchical structure. See section Section for more information.</p>	Either Item or Section is required	1 or more	Container

### Example:

```

<VirtualPatientData>
  <VPDText id="1" type="history">
    Mr. Jones has a history of high blood pressure but is in good health
    otherwise.
  </VPDText>
  <VPDText id="2" type="problem">
    Swelling of the ankles.
  </VPDText>
  <Organization>
    <Section>
      <Item idRef="1" label="history"/>
    </Section>
  </Section>

```

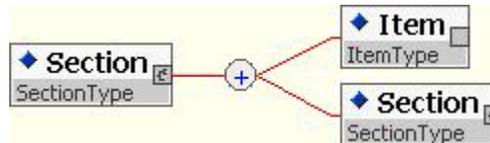
```

    <Item idRef="2" label ="problem"/>
  </Section>
</Organization>
</VirtualPatientData>

```

### 5.2.10.1 Section

Section aggregates data items into meaningful groups. Section is a branch within the hierarchical structure. Each section may contain additional sections and items.



#### Section Element Information

Element	Description	Required	Multiplicity	Datatype
<b>Section</b>	Section is the subelement of Organization that aggregates data items into meaningful groups. Section is a branch within the hierarchical structure. Section is recursive; each Section may contain additional sections and items.	Either Item or Section is required	1 or more	Container

Element	Description	Required	Multiplicity	Datatype
Item	<p>Item is the subelement of Organization. Item points to a single piece of data. Item indicates the unique id of a single virtual patient data element within this dataset. Item is a leaf within the hierarchical structure.</p> <p>Item has the following attributes:</p> <p><i>idRef</i> The unique identifier of the data within this dataset.</p> <p><i>label</i> A label for this piece of data, such as Chief Complaint.</p> <p><i>source</i> The taxonomy or vocabulary serving as the source of a description of this item.</p> <p><i>sourceID</i> The unique identifier assigned to this taxonomic reference within the taxonomy or vocabulary.</p>	Either Item or Section is required	1 or more	Empty

Example:

```
<Section>
  <Item idRef="1" label="history"/>
</Section>
```

### 5.2.11 XtensibleInfo

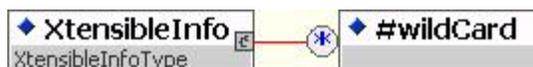


Figure 3: XtensibleInfo

## XtensibleInfo Element Information

Element	Description	Required	Multiplicity	Datatype
<b>XtensibleInfo</b>	The XtensibleInfo contains sub-elements defined by the organization implementing the schema. It extends the currently defined schema.  Elements listed in XtensibleInfo may be candidates for inclusion in a revision of the MedBiquitous Virtual Patient Specification. We encourage submission of these ideas to the MedBiquitous Virtual Patient Working Group.	Optional	0 or 1	Container
<b>#wildCard</b>	#wildCard is a place holder indicating that any element can be a child of XtensibleInfo.	Optional	0 or more	Any

## Example:

```
<XtensibleInfo>
  <somenamespace:identification>1234</somenamespace:identification >
  <somenamespace:authors>
    <somenamespace:author>Jon Smith</somenamespace:author>
    <somenamespace:author>Dr. Hopkins</somenamespace:author>
  </somenamespace:authors>
</XtensibleInfo>
```

Note: In this case, the designers of the case must add their own schema files to the package so that XML elements in XtensibleInfo can be validated. Additionally, authors should add their schemalocation and namespace to the top of the XML instance file.

## For example:

```
<VirtualPatientData xmlns="http://ns.medbiq.org/virtualpatientdata/v1/"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://ns.medbiq.org/virtualpatientdata/v1/
  virtualpatientdata.xsd http://virtualpatients.com/somenamespace
  somenamespace.xsd"
  xmlns:somenamespace="http://virtualpatients.com/somenamespace">
```

Extensions may be referenced through the Data Availability Model for inclusion in the virtual patient activity. The following example shows a QTI question embedded as an extension :

```

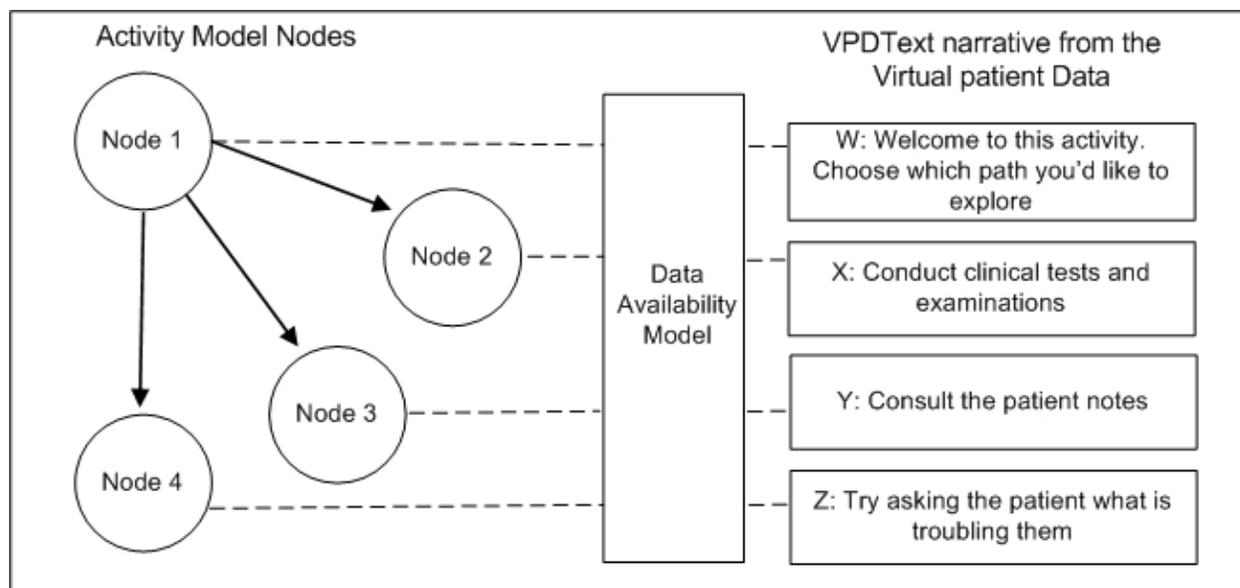
<XtensibleInfo>
  <qti:assessmentItem identifier="T2Q1" title="Unattended Luggage"
adaptive="false" timeDependent="false">
    <qti:responseDeclaration identifier="RESPONSE" cardinality="single"
baseType="identifier">
      <qti:correctResponse>
        <qti:value>ChoiceA</qti:value>
      </qti:correctResponse>
    </qti:responseDeclaration>
    <qti:outcomeDeclaration identifier="SCORE" cardinality="single"
baseType="integer">
      <qti:defaultValue>
        <qti:value>0</qti:value>
      </qti:defaultValue>
    </qti:outcomeDeclaration>
    <qti:itemBody>
      <qti:choiceInteraction responseIdentifier="RESPONSE" shuffle="false"
maxChoices="1">
        <qti:prompt>What is the appropriate treatment for John Smith's
condition?</qti:prompt>
        <qti:simpleChoice identifier="ChoiceA">Beta
blocker</qti:simpleChoice>
        <qti:simpleChoice identifier="ChoiceB">Daily low-dose
aspirin</qti:simpleChoice>
        <qti:simpleChoice identifier="ChoiceC">No treatment is
necessary.</qti:simpleChoice>
      </qti:choiceInteraction>
    </qti:itemBody>
    <qti:responseProcessing
template="http://www.imsglobal.org/question/qti_v2p1/rptemplates/match_correc
t"/>
  </qti:assessmentItem>
</XtensibleInfo>

```

### 5.3 Using Virtual Patient Data

The following example presents an illustrative series of elements that might be used within a virtual patient.

The VPDText element may contain narrative that creates a content path within the activity model. In this case, VPDText elements with a textType attribute of narrative are paired with nodes in the Activity Model through the DataAvailabilityModel (see Figure 4).



**Figure 4: Relationships between activity model nodes, DAMNodes and VPD narrative element  $t$**

In addition to passively displaying data elements, there are some situations in which data elements need to be triggered to display related elements. For instance, in the case of ordering tests, only those tests that have been requested should be shown to the user. This makes use of the mandatory tracking functions within an MVP player. For more information see section `DataAvailabilityModel` and the *MedBiquitous Virtual Patient Player Specifications and Description Document*.

## 6 Media Resources, the Manifest and SCORM Compliance

MVP content packages are SCORM 2004 4<sup>th</sup> edition content packages. These packages use IMS Content Packaging v1.1.4. An IMS content package is a zip file containing an XML manifest file and one or more files each of which are referenced in the manifest. In the manifest each media resource is given a unique identifier in the resource element. The resource element also contains the file location of the media resource file.

Here is an example resource element from the manifest:

```
<resource identifier="R_A2" type="webcontent" adlcp:scormType="asset"
href="xray.jpg">
  <file href="xray.jpg" />
</resource>
```

The referencing of media resources in the virtual patient XML takes advantage of manifest's architecture. Media Resources are referenced as XPath's from the DAMNode element. The XPath points to the resource element of the media resource in the manifest. Given the resource element of a media file, the file location can be determined by looking in the href attribute.

For more information about SCORM content packages, see *SCORM® 2004 4th Edition Content Aggregation Model (CAM) Version 1.0*.

### 6.1 Media Resource Foundations

An MVP media resource needs to be a discrete, addressable and MIME resolvable file. Media formats that are supported are:

- Images: JPEG, GIF and PNG
- Video: MPEG2, MPEG4, MOV, FLV, WMV and RM
- Audio: MP3 and WAV
- Documents: RTF and PDF
- Animations/vector: SWF

Formats like WMV and RM are included to support legacy systems. Case designers should do their best to use platform independent formats when designing new cases.

## 6.2 Manifest Structure in MVP Packages

The manifest serves as a resource aggregator. When packages are exported from and imported to an LMS or virtual patient system, the manifest enables the system to know which resources belong to which packages.

There are two application profiles of SCORM:

- Resource Package – a profile that bundles learning resources with no organization or sequencing instructions for the SCORM LMS. Use this application profile to exchange virtual patient activities with another virtual patient authoring or delivery system. No player is needed in the content package.
- Content Aggregation Package – a profile that bundles learning resources and their structure and sequencing. Use this application profile if you plan to include the player in the content package and make content available for use in a SCORM-conformant LMS.

For both application profiles, the manifest provides a mapping from media resource identifiers to media file locations in the package. Virtual Patient players can look up a media resource's identifier and file location in the manifest, enabling the player to render the resource.

In SCORM Content Aggregation Packages, the manifest has a role as a reference to the launch point of the virtual patient. This enables the LMS to know which file to launch in order to start the virtual patient activity.

The basic XML structure of the manifest is as follows<sup>1</sup>:

```
<manifest>
  <metadata/>
  <organizations/>
  <resources/>
</manifest>
```

*Metadata* contains information about the package, *organizations* contains information about the way any resources are organized (such as the order in which they should be presented by an LMS), and *resources* references each file included in the package.

### 6.2.1 Metadata

The metadata element under the Manifest element contains information about the virtual patient package. This metadata element specifies the type and version of the package and may reference an external metadata file using the `adlcp:location` element. Virtual patient packages are SCORM 2004 4<sup>th</sup> Edition packages.

---

<sup>1</sup> see the IMS Content Packaging Best Practice and Implementation Guide at [http://www.imsproject.org/content/packaging/cpv1p2pd/imscp\\_bestv1p2pd.html](http://www.imsproject.org/content/packaging/cpv1p2pd/imscp_bestv1p2pd.html)

Example:

```
<metadata>
  <schema>ADL SCORM</schema>
  <schemaversion>2004 4th Edition</schemaversion>
  <adlcp:location>metadata.xml</adlcp:location>
</metadata>
```

For more information on metadata in the manifest, see *SCORM® 2004 4th Edition Content Aggregation Model (CAM) Version 1.0*. Healthcare Learning Object Metadata (Healthcare LOM) may be used as the metadata format. For more information on using Healthcare LOM, see *SCORM for Healthcare and Healthcare Learning Object Metadata Specifications and Descriptions Document*.

## 6.2.2 Organizations

For those virtual patient packages that are SCORM Resource Packages, the organizations element is an empty element:

```
<organizations/>
```

For those virtual patient packages that are SCORM Content Aggregation Packages, there is only one organization sub-element in the organizations element. This is because the standard currently only allows only one virtual patient per virtual patient package. Further, the organization element has only one item element within it.

The item element in organization points to the launchable html wrapper page which will in turn launch the virtual patient player. This is the same launchable resource that is included in the resources section. See section Resource for more information.

The following is an example an organization section for a SCORM Content Aggregation Package, courtesy Shawn Thropp, Concurrent Technologies Corporation:

```
<organizations default="defaultorg">
  <organization identifier="defaultorg" structure="hierarchical" >
    <title>The org title</title>
    <item identifier="I1" identifierref="R_A1">
      </item>
    </organization>
  </organizations>
```

For more information on ‘organization’ in the manifest see *SCORM® 2004 4th Edition Content Aggregation Model (CAM) Version 1.0*.

### 6.2.3 Resources

Each media resource will be identified within a content packaging manifest using the resource element consisting of a unique identifier and a file child element with a path/location defined by a href property, which will refer to the file's location within the package. Note that paths need to be relative in a package to accommodate subdirectories.

The resource identifier will be used to target the resource from a Data Availability Model. Note the Activity Model cannot directly access resources and must pass through the DAM. Resource identifiers therefore need to be unique within a manifest.

Because there is only one virtual patient per content package, the manifest must indicate one launchable SCO (Sharable Content Object), which is tracked by the LMS as a learning activity. All other resources in the package are referred to as assets because they will be used in the context of the SCO. The launchable resource is given an adlcp:scormType attribute of sco. It references the launch point in its href attribute. The launch point is an html wrapper file that launches the virtual patient activity and contains javascript for communicating with the LMS. Each resource must be included as a dependency to this launchable resource in order for the LMS to recognize all resources that belong to this particular SCO.

The following is an example resources section courtesy Schawn Thropp, Concurrent Technologies Corporation:

```
<resources>
  <resource identifier="R_A1" type="webcontent" adlcp:scormType="sco"
href="launchVP.html">
    <file href="launchVP.html" />
    <dependency identifierref="R_A2" />
    <dependency identifierref="R_A3" />
    <dependency identifierref="R_A4" />
    <dependency identifierref="R_A5" />
    <dependency identifierref="R_A6" />
    <dependency identifierref="R_A7" />
    <dependency identifierref="R_A8" />
    <dependency identifierref="R_A9" />
  </resource>
  <resource identifier="R_A2" type="webcontent" adlcp:scormType="asset"
href="xray.jpg">
    <file href="xray.jpg" />
  </resource>
  <resource identifier="R_A3" type="webcontent" adlcp:scormType="asset"
href="xray2.jpg">
    <file href="xray2.jpg" />
  </resource>
  <resource identifier="R_A4" type="webcontent" adlcp:scormType="asset"
href="xray_simulation.swf">
    <file href="xray_simulation.swf" />
  </resource>
  <resource identifier="R_A5" type="webcontent" adlcp:scormType="asset"
href="patient_report.pdf">
    <file href="patient_report.pdf" />
  </resource>
```

```
<resource identifier="R_A6" type="webcontent" adlcp:scormType="asset"
href="activitymodel.xml">
  <file href="activitymodel.xml" />
</resource>
<resource identifier="R_A7" type="webcontent" adlcp:scormType="asset"
href="dataavailabilitymodel.xml">
  <file href="dataavailabilitymodel.xml" />
</resource>
<resource identifier="R_A8" type="webcontent" adlcp:scormType="asset"
href="virtualpatientdata.xml">
  <file href="virtualpatientdata.xml" />
</resource>
```

A media resource can be referenced within a DAM node using an XPath expression. Alternately, a media resource can be referenced within VPDText using the media tag extension with an XPath expression or using the XHTML img tag. Referencing media within the DAM is the preferred approach.

For more information on resources in the SCORM manifest, see *SCORM® 2004 4th edition Content Aggregation Model (CAM) Version 1*.

#### **6.2.3.1 Referencing within a Manifest**

Each media resource must be referenced using a resource element within the resources section of the manifest of a MedBiquitous Virtual Patient Content Package.

The following table describes the attributes and subelements of resource used by the MedBiquitous Virtual Patient specification.

### Resource Element Description

Element	Description	Required	Multiplicity	Datatype
resource	<p>resource is the subelement of resources that identifies and describes a single media resource, such as an image, audio, video, or animation file.</p> <p>The following resource attributes are used by MedBiquitous Virtual Patient specification:</p> <p><i>identifier</i> A unique identifier for this resource.</p> <p><i>type</i> Indicates the type of resource in reference to the IMS specifications framework. For virtual patient resources, the type is webcontent.</p> <p><i>adlcp:scormType</i> This attribute is used by the LMS in order to determine the type of the resource from a SCORM perspective. Valid values are sco and asset.</p> <p>If the value is sco, the LMS will expect the SCO to initialize and terminate the activity and possibly report back information.</p> <p>If the value is asset, the LMS will simply launch the asset. No further communication occurs between the LMS and the asset.</p> <p><i>href</i> This indicates the path to the resource.</p>	Required	1 or more	Container

Element	Description	Required	Multiplicity	Datatype
file	<p>file is the subelement of resource that identifies a single file of the resource. If a resource is dependent on multiple files, each of those files is listed separately.</p> <p>file has the following attribute:</p> <p><i>href</i> The local path to a file used by the resource.</p>	Optional	0 or more	Container
dependency	<p>dependency is a subelement of resource that points to other resources upon which the current resource depends.</p> <p>A Virtual Patient Player is dependant on all three component xml files (activitymodel.xml, dataavailabilitymodel.xml, virtualpatientdata.xml), the Manifest (imsmanifest.xml) as well as any and all media resources used in the activity.</p> <p>dependency has the following attribute:</p> <p><i>identifierref</i> This attribute holds the identifier of the resource to which this dependency is pointing to.</p>	Optional	0 or more	Container

Example:

The following is an example resources section courtesy Schawn Thropp, Concurrent Technologies Corporation:

```

<resources>
  <resource identifier="R_A1" type="webcontent" adlcp:scormType="sco"
href="vpp.html">
    <file href="vpp.html"/>
    <dependency identifierref="R_A2"/>
    <dependency identifierref="R_A3"/>
  </resource>
  <resource identifier="R_A2" type="webcontent" adlcp:scormType="asset"
href="xray.jpg">
    <file href="xray.jpg" />
  </resource>

```

```
<resource identifier="R_A3" type="webcontent" adlcp:scormType="asset"
href="xray2.jpg">
  <file href="xray2.jpg" />
</resource>
...
</resources>
```

#### 6.2.4 Referencing within a Data Availability Model

Once media resources have been referenced within the manifest file and given a unique ID, the Data Availability Model (DAM) may reference these resources as part of an aggregation of data to be presented to the learner. The ItemPath within the DAMNodeItem element of the DAM is used to reference the unique ID of the media resource using XPath. For more information, see section DAMNodeItem and ItemPath in the section Data Availability Model. For information on using XPath, see section Identifying Virtual Patient Data and Resources.

The following sample reference shows a resource id being used in a DAMNode:

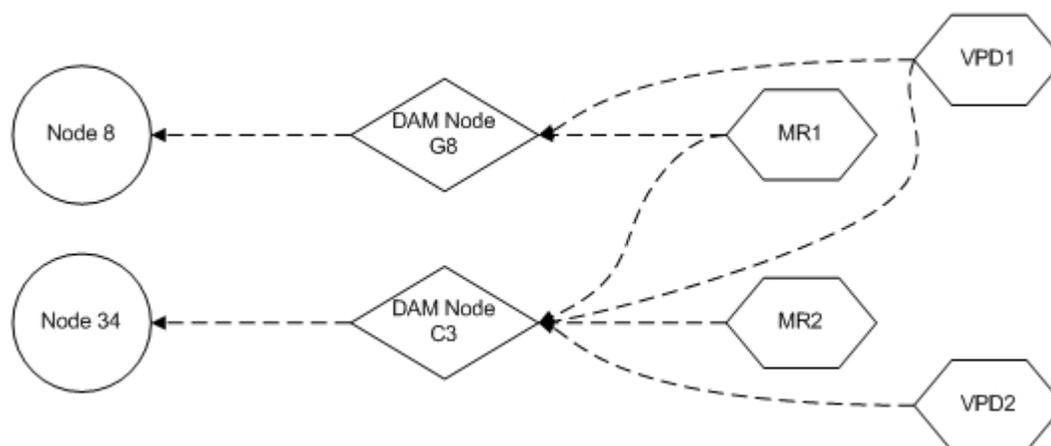
```
<DAMNode id="321">
  <DAMNodeLabel>
    X-Ray
  </DAMNodeLabel>
  <DAMNodeItem display="immediately">
    <ItemPath>
      /manifest/resources/resource[@identifier = 'KEDI493']
    </ItemPath>
    <ItemOrder>2</ItemOrder>
  </DAMNodeItem>
  ...
</DAMNode>
```

## 7 Data Availability Model

### 7.1 Data Availability Model Principles and Data Elements

The function of the data availability model (DAM) is to create arbitrary aggregations of virtual patient data (VPD) and media resource (MR) elements for display purposes. The DAM can reference multiple VPD and MR elements. One Activity Model (AM) node may reference several DAM nodes, or one AM node may reference only one DAM node. This affords flexibility and reusability within the MVP. In practical terms the DAM allows virtual patient authors or editors to progressively reveal clinical data as part of the learning activity or to group it together to represent a patient history, a bank of test results, or some other collection of elements.

The relationship among the AM, DAM, VPD and MR components is shown in figure Figure 5.



**Figure 5: Relationship among virtual patient data, media resources, DAM nodes, and AM nodes.**

In this diagram both DAM nodes reference VPD element 1 and MR element 1 while VPD2 and MR2 are referenced by DAM node C3 only. Each AM node references only one DAM node. At AM node 8, the user would see VPD element 1 and MR element 1. At AM node 34, the user would see VPD 1 and MR1 (that they previously saw at AM node 8) as well as VPD2 and MR2.

Because a DAM node can contain many different VPD or MR elements, any VPD or MR element can appear in many DAM nodes. There is very fine control over what gets shown at what stage. It should be noted that the DAM does not control how Virtual Patient Data and Media Resource items are presented to the user; this is up to the player to determine.

It should also be noted that the DAM is required to link Virtual Patient Data and Media Resource elements to an activity as they cannot be referenced directly in the Activity Model.

The Data Availability Model schema includes the following data elements. In some cases, these elements contain subelements.

1. DataAvailabilityModel
2. DAMNode
3. DAMNodeLabel
4. DAMNodeItem
5. XtensibleInfo

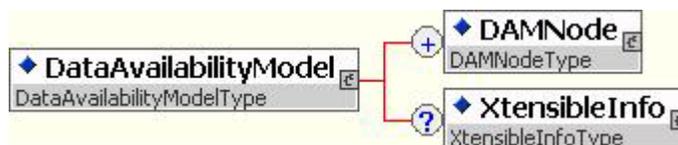
## 7.2 Data Availability Model Schema Grammar

The following sections explain the Data Availability Model Schema grammar. Values in bold under XML Tags column indicate that the element has sub-elements.

All the elements having sub-elements will be defined in separate sections. All elements without sub-elements will be defined within the appropriate element sections that use them.

### 7.2.1 DataAvailabilityModel

DataAvailabilityModel is the root element. It contains elements that group virtual patient data and media resources into nodes that allow data to be aggregated and progressively disclosed to the learner. DataAvailabilityModel must occur once and only once within a DataAvailabilityModel document.



DataAvailabilityModel has the following elements.

DataAvailabilityModel Element Information

Element	Description	Required	Multiplicity	Datatype
<b>DataAvailabilityModel</b>	DataAvailabilityModel is the root element. It contains elements that group virtual patient data and media resources into nodes that are referenced from the activity model.	Required	1	Container

Element	Description	Required	Multiplicity	Datatype
<b>DAMNode</b>	DAMNode is a the subelement of DataAvailabilityModel that groups virtual patient data and media resources that may be referenced in the activity model or elsewhere in the DAM. See section DAMNode for more information.	Required	1 or more	Container
<b>XtensibleInfo</b>	<p>The XtensibleInfo is a subelement of DataAvailabilityModel. It contains sub-elements defined by the organization implementing the schema. It extends the currently defined schema.</p> <p>Virtual Patient decision path should not be dependent on data within XtensibleInfo as many systems will not be able to use this data.</p> <p>Elements listed in XtensibleInfo may be candidates for inclusion in a revision of the MedBiquitous Virtual Patient Specification. We encourage submission of these ideas to the MedBiquitous Virtual Patient Working Group.</p> <p>See XtensibleInfo section for more information.</p>	Optional	0 or 1	Container

### Example:

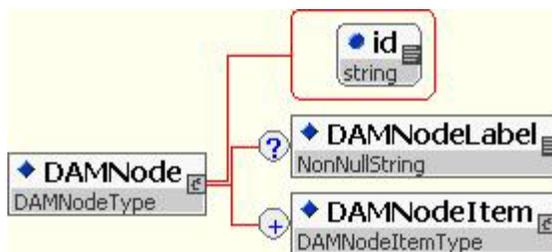
```

<DataAvailabilityModel>
  <DAMNode> ... </DAMNode>
  <DAMNode> ... </DAMNode>
  <DAMNode> ... </DAMNode>
  <DAMNode> ... </DAMNode>
  <XtensibleInfo> ... </XtensibleInfo>
</DataAvailabilityModel>

```

## 7.2.2 DAMNode

DAMNode is a group of virtual patient data and media resources that may be referenced in the activity model or elsewhere in the DAM.



### DAMNode Element Information

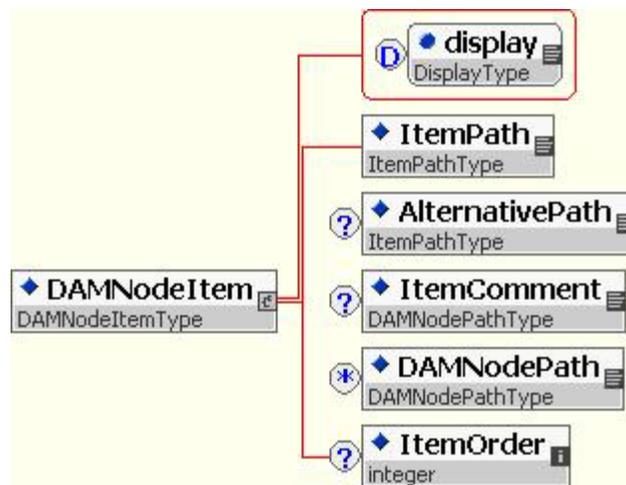
Element	Description	Required	Multiplicity	Datatype
<b>DAMNode</b>	<p>DAMNode is the subelement of DataAvailabilityModel that groups virtual patient data and media resources so that the group may be referenced in the activity model or elsewhere in the DAM.</p> <p>DAMNode has the following attribute:</p> <p><i>id</i> A unique identifier for this group of data that can be used to control the availability of data to the learner. The id attribute is required.</p>	Required	1 or more	Container
<b>DAMNodeLabel</b>	<p>DAMNodeLabel is the subelement of DAMNode. DAMNodeLabel provides a text label for this group of data. This label is used for authoring purposes and the player will ignore its content.</p>	Optional	0 or 1	Non-null String
<b>DAMNodeItem</b>	<p>DAMNodeItem is the subelement of DAMNode that references an element within the VPD or a media resource. DAMNodeItem is repeated within a DAMNode to create a group of data elements and media resources. See section DAMNodeItem for more information.</p>	Required	1 or more	Container

Example:

```
<DAMNode id="324">
  <DAMNodeLabel> Patient Introduction </DAMNodeLabel>
  <DAMNodeItem>
    ...
  </DAMNodeItem>
</DAMNode>
```

### 7.2.3 DAMNodeItem

DAMNodeItem references an element within the VPD or a media resource. DAMNodeItem is repeated within a DAMNode to create a group of data elements and media resources.



## DAMNodeItem Element Information

Element	Description	Required	Multiplicity	Datatype
<b>DAMNodeItem</b>	<p>DAMNodeItem is the subelement of DAMNode that references an element within the VPD, a media resource, or another DAMNode.</p> <p>DAMNodeItem has the following attribute:</p> <p><b>display</b></p> <p>display can have the following values: immediately, ontrigger, delayed or ifrequested. The default value is immediately.</p> <p>This attribute modifies how data referenced in ItemPath, ItemComment, and DAMNodePath are displayed. Data may be displayed immediately, after a user interaction (ontrigger), at a later point in the virtual patient activity (delayed) or at a later point in the activity only if the user interacted with the DAMNodeItem data, i.e. ordered the test (Ifrequested). For example, a virtual patient may be designed so that a user must order a diagnostic test before seeing the results. For more information, see section Triggering Data Display in the <i>MedBiquitous Virtual Patient Player Specifications and Description Document</i>,</p>	Required	1 or more	Container

Element	Description	Required	Multiplicity	Datatype
ItemPath	<p>ItemPath is the subelement of DAMNodeItem that provides an XPath which points to the virtual patient data element in the VPD or media resource in the manifest to be included in this item. VPD extensions in the XtensibleInfo container may be referenced.</p> <p>The valid values for ItemPath are:</p> <pre>/VirtualPatientData/path</pre> <p>and</p> <pre>/manifest/resources/resource[@identifer='Y']</pre> <p>All on one line, where <i>path</i> is the remaining XPath needed to point to a specific piece of data within VirtualPatientData.xml and Y is the unique identifier associated with the media resource within the manifest.</p>	Required	1	<p>Restricted (to conformant XPath)</p> <p>See section Identifying Data and Resources through XPath for more information.</p>
AlternativePath	<p>AlternativePath is the subelement of DAMNodeItem that provides alternative content in the event that the ItemPath element points to XtensibleInfo. AlternativePath should only be used if the ItemPath points to an XtensibleInfo element. The valid values for AlternativePath are:</p> <pre>/VirtualPatientData/path</pre> <p>and</p> <pre>/manifest/resources/resource[@identifer='Y']</pre> <p>All on one line, where <i>path</i> is the remaining XPath needed to point to a specific piece of data within VirtualPatientData.xml and Y is the unique identifier associated with the media resource within the manifest.</p>	Optional	0 or 1	<p>Restricted (to conformant XPath)</p> <p>See section Identifying Data and Resources through XPath for more information.</p>

Element	Description	Required	Multiplicity	Datatype
ItemComment	<p>ItemComment is the subelement of DAMNodeItem that contains an XPath that points to a DAMNode associated with this item. The DAMNode referenced in ItemComment contains feedback that the patient designer wants the learner to see after the learner triggers an element. The valid values for ItemComment are:</p> <pre>/DataAvailabilityModel/ DAMNode[@id = 'X']</pre> <p>All in one line, where X is the id of a DAM Node.</p> <p>Cyclic inclusions, referencing a DAMNode that ultimately leads to a DAMNode including itself, are not permitted.</p> <p>Note that data are displayed in accordance to the display rules set by the DAMNode referenced by ItemComment.</p> <p>For more information, see section Triggering Data Display in the <i>MedBiquitous Virtual Patient Player Specifications and Description Document</i>.</p>	Optional	0 or 1	<p>Restricted (to conformant XPath)</p> <p>See section Identifying Data and Resources through XPath for more information.</p>

Element	Description	Required	Multiplicity	Datatype
DAMNodePath	<p>DAMNodePath is the subelement of DAMNodeItem that provides an XPath to a DAMNode to be included in this group of data. There is a hierarchical relationship between the DAMNode referenced by DAMNodePath and the parent node that contains it. The valid values for DAMNodePath are:</p> <pre>/DataAvailabilityModel/ DAMNode[@id = 'X']</pre> <p>All in one line, where X is the id of a DAM Node.</p> <p>Cyclic inclusions, referencing a DAMNode that ultimately leads to a DAMNode including itself, are not permitted.</p> <p>Note that data are displayed in accordance to the display rules set by the DAMNode referenced by DAMNodePath.</p> <p>For more information, see section <i>Triggering Data Display in the MedBiquitous Virtual Patient Player Specifications and Description Document</i>.</p>	Optional	0 or more	Restricted (to conformant XPath)  See section <i>Identifying Data and resources through XPath for more information</i> .
ItemOrder	<p>ItemOrder is the subelement of DAMNodeItem that indicates the order of this item relative to other items in this DAMNode. The Player uses ItemOrder to determine the order of items when displaying data to the learner.</p>	Optional	0 or 1	Integer

### Example:

```
<DAMNodeItem display="immediately">
  <ItemPath>
    /VirtualPatientData/InterviewItem[@id = '6']
  </ItemPath>
  <ItemComment>
    /DataAvailabilityModel/DAMNode[@id = '321']
  </ItemComment>
  <DAMNodePath>
    /DataAvailabilityModel/DAMNode[@id = '545']
  </DAMNodePath>
  <ItemOrder>1</ItemOrder>
</DAMNodeItem>
```

The following example references a QTI question embedded in an XtensibleInfo container of VirtualPatientData.

```
<DAMNodeItem>
  <ItemPath>
    /VirtualPatientData/XtensibleInfo/qti:assessmentItem[@identifier = 'T2Q1']
  </ItemPath>
</DAMNodeItem>
```

## 7.3 Using the Data Availability Model

There are many ways in which the DAM can be used to collect and display data and media to the user. The following examples are intended to exemplify just a few of the ways that the DAM can be used in practice.

### 7.3.1 Progressive Release

In some virtual patient activities the author may wish to progressively release data as it occurs in the narrative. In this case a series of DAM nodes are created with elements added to represent each stage in the data exposure. These DAM nodes are next linked to successive activity model nodes so that the user sees more and more data as they move through the activity (see figure r).

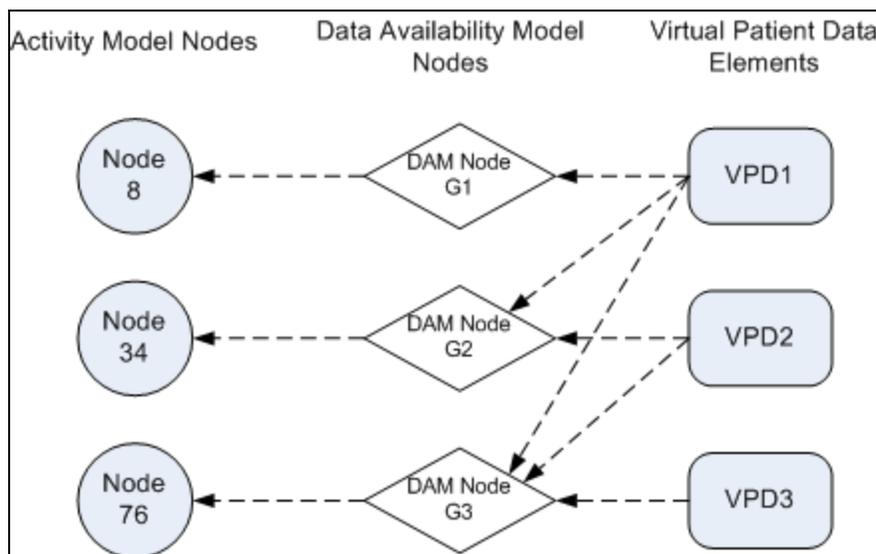
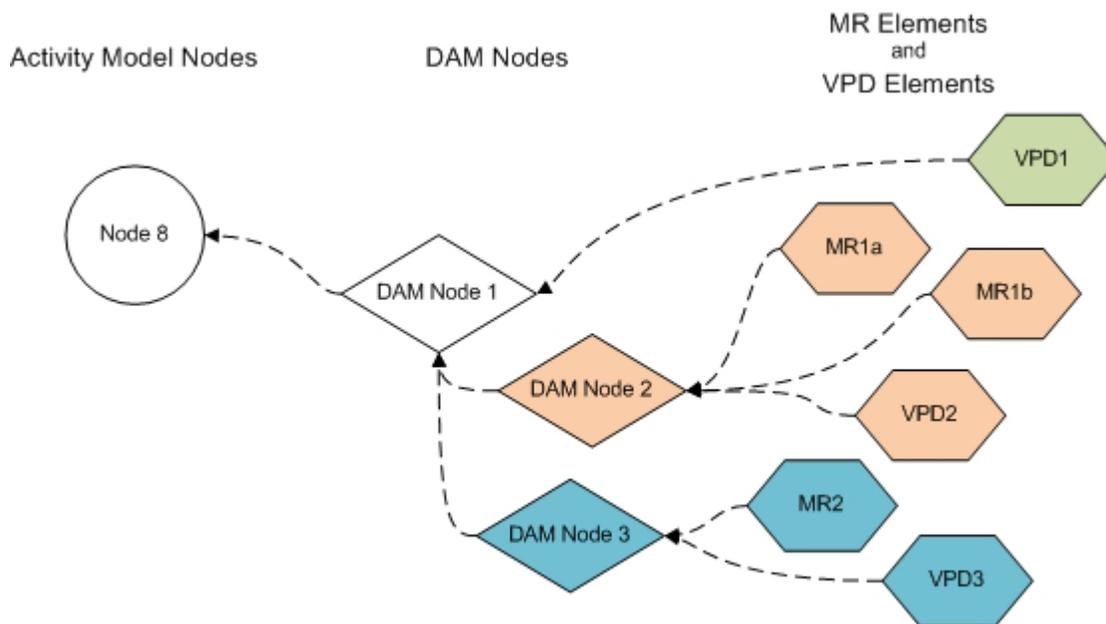


Figure 6: Progressive release of data using DAM nodes

In this example, DAM node G1 contains element VPD1, DAM node G2 contains elements VPD1 and VPD2, and DAM node G3 contains elements VPD1, VPD2 and VPD3. These DAM nodes are referenced at successively later points in the activity.

### 7.3.2 Data Blocks

Typically data and media need to be arranged in blocks, for instance as a set of test results, a patient history, a medications kardex, the results of a physical examination or a bank of investigations. In this case each collection is assembled as a separate DAM node and aggregated via another DAM node (see Figure 7). The way they are displayed is up to the player.



1

Figure 7: multiple data blocks

In this figure, “DAM Node 1” contains one VPD element (referenced in the DAMNodeItem element) as well as 2 DAMNode references (referenced in the DAMNodePath element inside DAMNodeItem). These referenced DAMNodes (Node 2 and Node 3) contain reference to further data from the VPD as well as media resources. In this way, data from multiple DAMNodes can be aggregated. Note that the data presented in from DAMNode 2 and DAMNode 3 has a hierarchical relation to the data referenced directly by DAMNode 1.

Following is XML for the DAM in the diagram above:

```
<?xml version="1.0" encoding="UTF-8"?>
<DataAvailabilityModel xmlns="http://ns.medbiq.org/dataavailabilitymodel/v1/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/dataavailabilitymodel/v1/
dataavailabilitymodel.xsd">
  <DAMNode id="DAMNode1">
    <DAMNodeItem >
      <ItemPath>/VirtualPatientData/VPDText[@id = 'VPD1']</ItemPath>
      <DAMNodePath>/DataAvailabilityModel/DAMNode[@id =
'DAMNode2']</DAMNodePath>
      <DAMNodePath>/DataAvailabilityModel/DAMNode[@id =
'DAMNode3']</DAMNodePath>
      <ItemOrder>1</ItemOrder>
    </DAMNodeItem>
  </DAMNode>
  <DAMNode id="DAMNode2">
    <DAMNodeItem >
      <ItemPath>/manifest/resources/resource[@identifier = 'MR1a']</ItemPath>
      <ItemOrder>1</ItemOrder>
    </DAMNodeItem>
  </DAMNode>
  <DAMNode id="DAMNode3">
    <DAMNodeItem >
      <ItemPath>/manifest/resources/resource[@identifier = 'MR2']</ItemPath>
      <ItemOrder>1</ItemOrder>
    </DAMNodeItem>
  </DAMNode>
</DataAvailabilityModel>
```

```
<DAMNodeItem >
  <ItemPath>/manifest/resources/resource[@identifier = 'MR1b']</ItemPath>
  <ItemOrder>2</ItemOrder>
</DAMNodeItem>
<DAMNodeItem >
  <ItemPath>>/VirtualPatientData/InterviewItem[@id = 'VPD2']</ItemPath>
  <ItemOrder>3</ItemOrder>
</DAMNodeItem>
</DAMNode>
<DAMNode id="DAMNode3">
<DAMNodeItem >
  <ItemPath>/manifest/resources/resource[@identifier = 'MR2']</ItemPath>
  <ItemOrder>1</ItemOrder>
</DAMNodeItem>
<DAMNodeItem >
  <ItemPath>/VirtualPatientData/DiagnosticTest[@id = 'VPD3']</ItemPath>
  <ItemOrder>2</ItemOrder>
</DAMNodeItem>
</DAMNode>
</DataAvailabilityModel>
```

## 8 Activity Model

### 8.1 Activity Model Principles and Data

The Activity Model (AM) encodes how the learner will be able to engage with the virtual patient. A number of different learner activities are possible with the same underlying virtual patient dataset, and the activity model component encodes the activities available, often structuring the narrative context.

The Activity Model allows developers to structure the following:

- A path through the activity
- Learner interactions with content and data
- User navigation controls, including content and activity sequencing based on learner actions or role
- Scoring criteria (both for assessment and content/activity sequencing purposes)
- Timer capabilities
- Learner redirection based on nodes visited and VPD data triggered

The AM defines what the user can do while the DAM is a bridge to what data is available to support the user's choices and actions.

What the learner can do and the consequences of any actions are expressed in the node structure, rules, and services defined in the Activity Model.

The Activity Model schema includes the following data elements. In some cases, these elements contain subelements.

1. ActivityModel
2. Properties
3. ActivityNodes
4. Links
5. XtensibleInfo

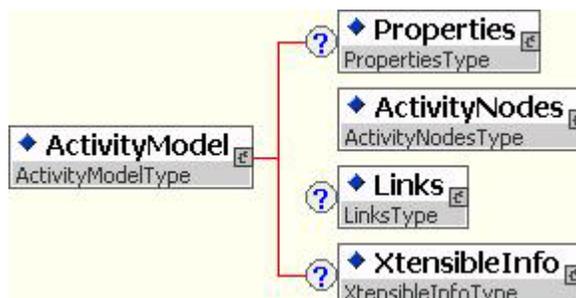
### 8.2 Activity Model Schema Grammar

The following sections explain the Activity Model Schema grammar. Values in bold under XML Tags column indicate that the element has sub-elements.

All the elements having sub-elements will be defined in separate sections. All elements without sub-elements will be defined within the appropriate element sections that use them.

## 8.2.1 ActivityModel

ActivityModel is the root element. It contains elements that create the learning activity for this virtual patient, including the possible paths through the content as well as scoring and timing mechanisms. ActivityModel must occur once and only once within an ActivityModel document.



ActivityModel Element Description

Element	Description	Required	Multiplicity	Datatype
<b>ActivityModel</b>	ActivityModel is the root element. It contains elements that create the learning activity for this virtual patient, including the possible paths through the content and scoring mechanisms.	Required	1	Container
<b>Properties</b>	Properties is a subelement of ActivityModel. It contains elements that define properties that apply to the entire activity model, including counters and timers. See section Properties for more information.	Optional	0 or 1	Container
<b>ActivityNodes</b>	ActivityNodes is a subelement of ActivityModel that defines the nodes available which form one or more paths through the learning activity. See section ActivityNodes for more information.	Required	1	Container
<b>Links</b>	Links is a subelement of ActivityModel that defines how one ActivityNode links to another ActivityNode to create a path through the learning activity. See section Links for more information.	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
<b>XtensibleInfo</b>	<p>The XtensibleInfo is a subelement of ActivityModel. It contains sub-elements defined by the organization implementing the schema. It extends the currently defined schema.</p> <p>Virtual Patient decision path should not be dependent on data within XtensibleInfo as many systems will not be able to use this data.</p> <p>Elements listed in XtensibleInfo may be candidates for inclusion in a revision of the MedBiquitous Virtual Patient Specification. We encourage submission of these ideas to the MedBiquitous Virtual Patient Working Group.</p> <p>See XtensibleInfo section for more information.</p>	Optional	0 or 1	Container

Example:

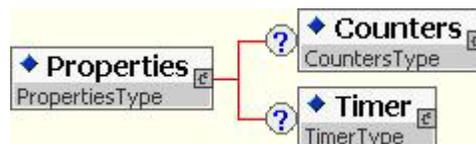
```

<ActivityModel>
  <Properties> ... </Properties>
  <ActivityNodes> ... </ActivityNodes>
  <Links> ... </Links>
  <XtensibleInfo> ... </XtensibleInfo>
</ActivityModel>

```

## 8.2.2 Properties

Properties define properties that apply to the entire activity model, including counters and timers.



## Properties Element Description

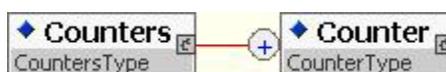
Element	Description	Required	Multiplicity	Datatype
<b>Properties</b>	Properties is a subelement of ActivityModel. It contains elements that define properties that apply to the entire activity model, such as counters, timers, and external services.	Optional	0 or 1	Container
<b>Counters</b>	Counters is a subelement of Properties. It contains subelements that define numeric counters present throughout the virtual patient activity. Counters enable a game-like environment where learners can earn or lose points in a certain category based on their actions. Counters can also be used for assessment. See section Counters for more information.	Optional	0 or 1	Container
<b>Timer</b>	Timer is a subelement of Properties. It defines a real-time timer which will run throughout the activity. The Timer enables the virtual patient author to restrict or measure the amount of time for this virtual patient activity. See section Timer for more information.	Optional	0 or 1	Container

Example:

```
<Properties>
  <Counters> ... </Counters>
  <Timer> ... </Timer>
</Properties>
```

### 8.2.3 Counters

Counters enable a game-like environment where learners can earn or lose points in a certain category based on their actions. Counters can also be used for assessment. Virtual Patient activities may have counters for patient health, costs, provider morale, and other measures.



## Counters Element Information

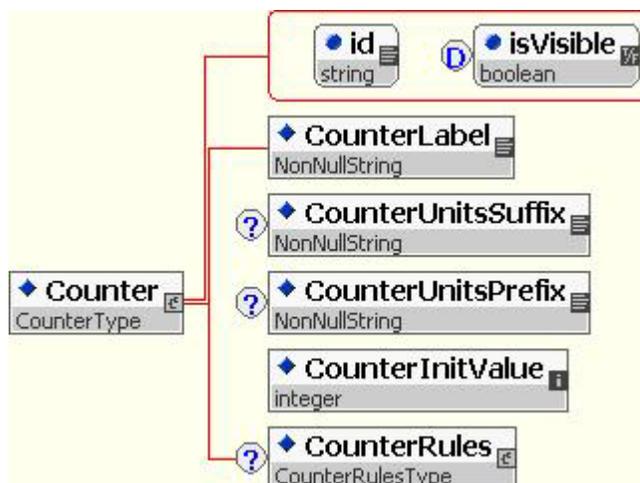
Element	Description	Required	Multiplicity	Datatype
<b>Counters</b>	Counters is a subelement of Properties. It contains subelements that define numeric counters present throughout the virtual patient activity. Counters enable a game-like environment where learners can earn or lose points in a certain category based on their actions. Counters can also be used for assessment.	Optional	0 or 1	Container
<b>Counter</b>	Counter is a subelement of Counters. It defines an individual numeric counter which will be present throughout the activity. Counters may be used for patient health, costs, or morale, for example. See section Counter for more information.	Required	1 or more	Container

Example:

```
<Counters>
  <Counter> ... </Counter>
  <Counter> ... </Counter>
  <Counter> ... </Counter>
</Counters>
```

### 8.2.4 Counter

Counter defines a single numeric counter for this virtual patient activity. The counter value may increase or decrease based on the actions a learner takes, enabling a game-like environment and measurement of learner knowledge and skills.



### Counter Element Information

Element	Description	Required	Multiplicity	Datatype
<b>Counter</b>	<p>Counter is a subelement of Counters. It defines an individual counter which will be present throughout the activity. Counters may be used for patient health, costs, or morale, for example.</p> <p>Counter has the following attribute:</p> <p><i>id</i> A unique identifier for this counter that can be used to increase or decrease the counter value depending on the learner's actions. The id attribute is required.</p> <p><i>isVisible</i> A true/false attribute which determines if the counter is shown to the learner or if it is hidden from the learner. True is the default value.</p>	Required	1 or more	Container
CounterLabel	CounterLabel is the subelement of Counter that provides a text label for this counter that may be used in presenting the counter and its value to the learner. For example, Patient Health Score.	Required	1	Non-null String

Element	Description	Required	Multiplicity	Datatype
CounterUnitsSuffix	CounterUnitsSuffix is the subelement of Counter that provides a text suffix for a counter value. For example, points.	Optional	0 or 1	Non-null String
CounterUnitsPrefix	CounterUnitsPrefix is the subelement of Counter that provides a text prefix for a counter value. For example, \$.	Optional	0 or 1	Non-null String
CounterInitValue	CounterInitValue is the subelement of Counter that defines the numeric value of this counter at the beginning of the virtual patient activity. For example, a patient encounter may begin with the patient healthcare funds set to 1000.	Required	1	Integer
<b>CounterRules</b>	CounterRules is a subelement of Counter. Its subelements define rules based on the counter value, either redirecting a learner to another activity node or showing a message to the learner. See section CounterRules for more information.	Optional	0 or 1	Container

Example:

```
<Counter>
  <CounterLabel> Morale </CounterLabel>
  <CounterUnitsSuffix> Points </CounterUnitsSuffix>
  <CounterInitValue> 100 </CounterInitValue>
  <CounterRules> ... </CounterRules>
</Counter>
```

## 8.2.5 CounterRules

CounterRules allow virtual patient authors to redirect a learner based on the value of a counter. CounterRules can also be used to display a message to the learner based on the value of a counter. For example, a counter for patient health may display a warning message to the learner when the patient health counter drops below 25. Counter rules may be evaluated on a selective basis, only at nodes where the counter is relevant.



## CounterRules

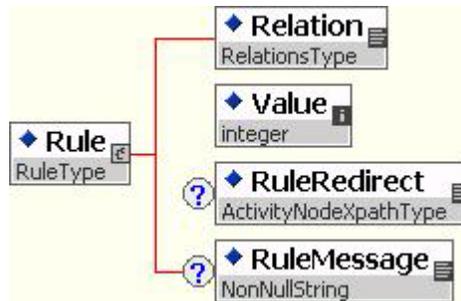
Element	Description	Required	Multiplicity	Datatype
<b>CounterRules</b>	CounterRules is a subelement of Counter. Its subelements define rules for redirecting a learner to another activity node or showing a message to the learner based on the counter value.	Required	1	Container
<b>Rule</b>	Rule is a subelement of CounterRules. It defines an individual rule for redirecting a learner to another activity node or showing a message to the learner based on the counter value. See section Rule for more information.	Required	1 or more	Container

Example:

```
<CounterRules>
  <Rule> ... </Rule>
  <Rule> ... </Rule>
</CounterRules>
```

## 8.2.6 Rule

Rule allows virtual patient authors to redirect a learner to another node in the activity model based on the value of a counter or the value of a timer. The Rule element can be found under CounterRules as well as TimerRules. Since counters are updated and by default their rules checked upon entry to an activity node, redirection happens when transitioning from one activity node to the other. Redirection caused by the elapse of a timer can either happen asynchronously or when transitioning between nodes depending on the player. Rule can also be used to display a message to the learner based on the value of a counter or timer. If both RuleRedirect and RuleMessage exist within a rule the player will both redirect the learner and display the message when this rule is triggered. For example, a counter for patient health may display a warning message to the learner and redirect them to an ‘emergency’ node when the patient health counter drops below 25. Alternately, a counter Rule may be evaluated only at relevant nodes in the activity model. For example, if a learner tries to enter a node to discharge the patient from the hospital, but the patient’s health score is too low to be discharged, the player may display a message or redirect the learner to a more appropriate node.



### Rule Element Description

Element	Description	Required	Multiplicity	Datatype
<b>Rule</b>	<p>Rule is a subelement of CounterRules and a subelement of TimerRules. It defines an individual rule for redirecting the learner to another node in the activity model or showing a message to the learner based on the counter value. For example, if the counter is less than 15, go to a failure node.</p> <p>Counter rules may be evaluated on a selective basis. For more information, see section CounterActionRule.</p>	Required	1 or more	Container
Relation	<p>Relation is a subelement of Rule that specifies a logical relation to a counter Value. When combined with a Value, this logical relation sets the point at which a counter rule is triggered.</p> <p>Valid values are: eq, neq, leq, lt, geq, gt.</p> <p>The valid values are defined below:</p> <p>eq: equal to            neq: not equal to            leq: less than or equal to            lt: less than            geq: greater than or equal to            gt: greater than</p>	Required	1	Restricted
Value	<p>Value is the subelement of Rule that specifies the numeric value of a relational expression. When combined with the Relations element, this value sets the point at which a counter rule is triggered.</p>	Required	1	Integer

Element	Description	Required	Multiplicity	Datatype
RuleRedirect	<p>RuleRedirect is a subelement of Rule that specifies the node to which a learner is redirected once this counter has been triggered. It contains a valid XPath to the activity node in the activity model to which the learner is redirected. If RuleRedirect is absent from the Rule element, no redirection occurs.</p> <p>The valid values for RuleRedirect are:</p> <pre>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='X']</pre> <p>All in one line, where X is the id of an Activity Node.</p>	Optional	0 or 1	Restricted (to conformant XPath) See section Identifying Data and Resources through XPath for more information.
RuleMessage	<p>RuleMessage is a subelement of CounterRule that defines a message to be shown to the learner when the counter rule has been triggered. The message may inform them that they will be redirected, that a counter limit has been reached, or may provide other feedback to the learner.</p>	Optional	0 or 1	Non-null String

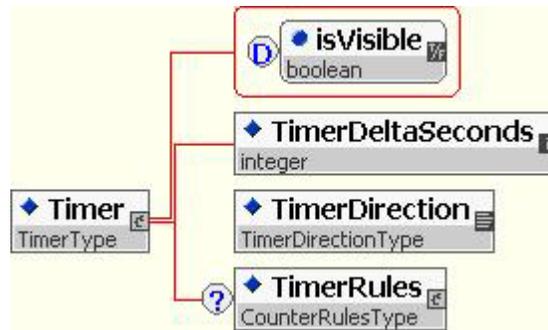
The following example shows a rule that is triggered when the Value of the Counter or the Timer to which it applies is less than or equal to 0. If the rule is triggered, the Virtual Patient Player will display the message shown and redirect the learner to Activity Node 324.

Example:

```
<Rule>
  <Relations> leq </Relations>
  <Value> 0 </Value>
  <RuleFunction>
    /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='324']
  </RuleFunction>
  <RuleMessage>
    Your patient's morale is so low that they attempt suicide. Try another
    approach.
  </RuleMessage>
</Rule>
```

## 8.2.7 Timer

Timer allows virtual patient authors to time all or part of a virtual patient activity, either providing a set amount of time and counting down, or starting with a set amount of time and counting up. Some educators may wish to use the timer as an assessment component.



Element	Description	Required	Multiplicity	Datatype
Timer	<p>Timer defines a real-time timer. If Timer is a subelement of Properties, the timer will run throughout the virtual patient activity. If Timer is a subelement of ActivityNode, the timer will run only for that activity node.</p> <p>The Timer enables the virtual patient author to restrict or measure the amount of time for a virtual patient activity or a node within a virtual patient activity, such as a test.</p> <p>Counter has the following attribute:</p> <p><i>isVisible</i></p> <p>A true/false attribute which determines if the timer is shown to the learner or if it is hidden from the learner. True is the default value.</p>	Optional	0 or 1	Container
TimerDeltaSeconds	<p>TimerDeltaSeconds is a subelement of Timer that defines the number of seconds on the timer at the beginning of the virtual patient activity.</p>	Required	1	Integer
TimerDirection	<p>TimerDirection is a subelement of Timer that indicates whether the timer will count up or down.</p> <p>Valid values are: up, down.</p>	Required	1	Restricted

Element	Description	Required	Multiplicity	Datatype
TimerRules	TimerRules is a subelement of Timer. Its subelements define rules for redirecting a learner to another activity node or showing a message to the learner based on the timer value.	Optional	0 or 1	Container

Example:

```
<Timer>
  <TimerDeltaSeconds> 180 </TimerDeltaSeconds>
  <TimerDirection> down </TimerDirection>
  <TimerRules>...</TimerRules>
</Timer>
```

### 8.2.8 TimerRules

TimerRules allow virtual patient authors to redirect a learner based on the value of a counter. TimerRules can also be used to display a message to the learner based on the value of a counter. For example, if the learner spends more than 2 minutes in a particular node, they may get a warning saying that a decision needs to be made quickly and that they only have only one minute left.



#### TimerRules

Element	Description	Required	Multiplicity	Datatype
<b>TimerRules</b>	TimerRules is a subelement of Timer. Its subelements define rules for redirecting a learner to another activity node or showing a message to the learner based on the timer value.	Required	1	Container
<b>Rule</b>	Rule is a subelement of TimerRules and CounterRules. It defines an individual rule for redirecting a learner to another activity node or showing a message to the learner based on the counter value or timer value. See section Rule for more information.	Required	1 or more	Container

Example:

```

<TimerRules>
  <Rule> ... </Rule>
  <Rule> ... </Rule>
</TimerRules>

```

## 8.2.9 ActivityNodes

ActivityNodes are points on the paths of a virtual patient learning activity. An ActivityNode references VPD or MR content through the DAM so that the virtual patient player may present that content to the learner at that point on the path. A path through the learning activity may branch to multiple ActivityNodes, or the path may lead to another ActivityNode in a linear fashion. A learner may also select their own path through the content if, for example, the activity is organized as a patient chart that the learner may browse.



ActivityNodes Element Information

Element	Description	Required	Multiplicity	Datatype
<b>ActivityNodes</b>	ActivityNodes is a subelement of ActivityModel that defines the nodes available on different paths through the learning activity.	Required	1	Container
<b>NodeSection</b>	NodeSection is a subelement of ActivityNodes. It defines a broad section which contains a set of related ActivityNodes. The virtual patient player uses the NodeSection to organize the presentation of content to the learner. See section NodeSection for more information.	Required	1 or more	Container

Example:

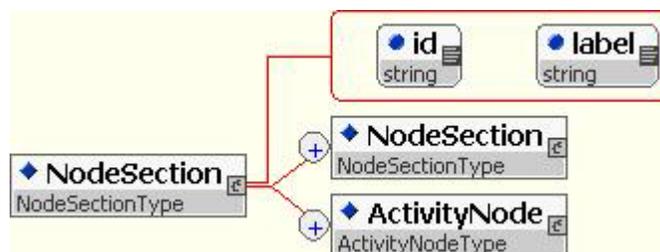
```

<ActivityNodes>
  <NodeSection> ... </NodeSection>
  <NodeSection> ... </NodeSection>
</ActivityNodes>

```

## 8.2.10 NodeSection

NodeSection contains a set of related ActivityNodes or other NodeSections. NodeSections organize content for presentation to the learner.



NodeSection Element Information

Element	Description	Required	Multiplicity	Datatype
<b>NodeSection</b>	<p>NodeSection is a subelement of ActivityNodes. It defines a broad section which contains a set of related ActivityNodes. The virtual patient player uses the NodeSection to organize the presentation of content to the learner.</p> <p>NodeSection is recursive and may contain other NodeSection elements. Either one or more NodeSection or one or more ActivityNode must occur within a NodeSection.</p> <p>NodeSection has the following attributes:</p> <p><i>id</i> A unique identifier for this node section. The id attribute is required.</p> <p><i>label</i> A text label that the virtual patient player uses to present the node section to the learner. The label attribute is required.</p>	Required	1 or more within ActivityNodes  Either NodeSection or ActivityNode must occur within a NodeSection.	Container
<b>ActivityNode</b>	<p>ActivityNode is a subelement of NodeSection. It contains subelements that define a single node on the learning path. See section ActivityNode for more information.</p>	Required	1 or more  Either NodeSection or ActivityNode must occur within a NodeSection.	Container

## Example 1:

```

<NodeSection id="3242" label="History">
  <ActivityNode> ... </ActivityNode>
  <ActivityNode> ... </ActivityNode>
  <ActivityNode> ... </ActivityNode>
  <ActivityNode> ... </ActivityNode>
</NodeSection>

```

## Example 2:

```

<NodeSection id="3252" label="History">
  <NodeSection> ... </NodeSection>
  <NodeSection> ... </NodeSection>
  <NodeSection> ... </NodeSection>
</NodeSection>

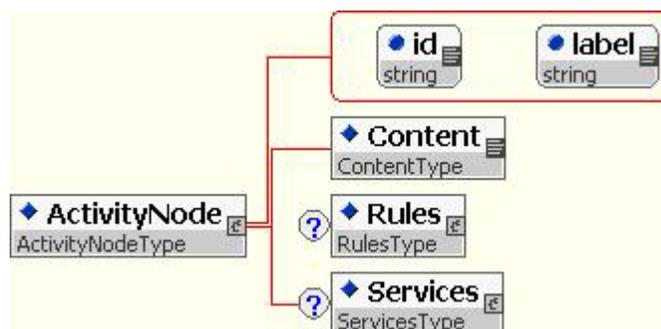
```

### 8.2.11 ActivityNode

An ActivityNode references virtual patient data and media resources content through the DAM so that the virtual patient player may present that content to the learner at that point on the path. An ActivityNode also contains rules that determine when an activity model node can be accessed and services that allow timers to be used at this point in the learning activity.

The first node in the Activity Model file is considered to be the first node in the activity. Similarly, the top node (in terms of location in the file) in each of each Node Section is the first node of the section.

A Node with no links pointing away from it or only a link going back to the first Activity Node is defined as an end node. In this case the player can choose to present information summarizing the activity (eg. path taken, counter scores, time spent in each node).



## ActivityNode Element Information

Element	Description	Required	Multiplicity	Datatype
<b>ActivityNode</b>	<p>ActivityNode is a subelement of NodeSection. It contains subelements that define a single node on the learning path.</p> <p>ActivityNode has the following attributes:</p> <p><i>id</i> A unique identifier for this activity node used to establish links between activity nodes. The id attribute is required.</p> <p><i>label</i> A text label that the virtual patient player uses to present the activity node to the learner. The label attribute is required.</p>	Required	1 or more	Container
Content	<p>Content is a subelement of ActivityNode that uses an XPath to reference a DAMNode the within the DAM. The elements located in this node are the contents that will be presented to the learner at this point on the learning path.</p> <p>Valid values have the following format/DataAvailabilityModel /DAMNode[@id = 'X']</p> <p>All in one line, where X is the id of a DAMNode.</p>	Required	1	Restricted (to conformant XPath)  See section Identifying Data and Resources through XPath for more information.
<b>Rules</b>	<p>Rules is a subelement of ActivityNode. It defines rules for accessing this activity node, increasing or decreasing predefined counters, as well as linking and navigating to other activity nodes. See section Rules for more information.</p>	Optional	0 or 1	Container
<b>Services</b>	<p>Services is a subelement of ActivityNode. It allows for the definition of a real-time timer for this ActivityNode. See section Services for more information.</p>	Optional	0 or 1	Container

## Example:

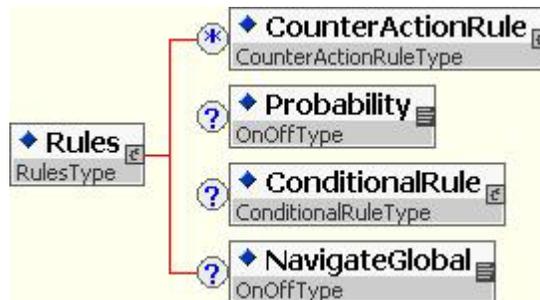
```

<ActivityNode id="AN342" label="Q/A time">
  <Content>
    /DataAvailabilityModel/DAMNode[@id = '342']
  </Content>
  <Rules> ... </Rules>
  <Services> ... </Services>
</ActivityNode>

```

### 8.2.12 Rules

Rules defines rules for accessing this activity node, increasing or decreasing predefined counters, and linking and navigating to other activity nodes.



#### Rules Element Information

Element	Description	Required	Multiplicity	Datatype
<b>Rules</b>	Rules is a subelement of ActivityNode. It defines rules for accessing this activity node, increasing or decreasing predefined counters, as well as linking and navigating to other activity nodes.	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
<b>CounterActionRule</b>	CounterActionRule is a subelement of Rules. CounterActionRule works with a counter defined by the Counter element within the activity model Properties (See section Counter for more information about Counters). It indicates whether to add or subtract value from a numeric counter or to set the counter equal to a set value when a learner enters this node. Counter rules may be evaluated selectively. See section CounterActionRule for more information.	Optional	0 or more	Container
Probability	Probability is a subelement of Rules that specifies whether departure from this node through links will be determined probabilistically. If probability is on, then the player will only display one link of all the links leaving the current node based on the probability weighting of each of the outgoing links. See section Weighting for more information.  Valid values are: on, off.	Optional	0 or 1	Restricted
<b>ConditionalRule</b>	ConditionalRule is a subelement of Rules. It contains a subelement that defines a Boolean expression used to determine if entrance to the node is possible. It also contains elements that specify to which node a user is redirected and/or what message to show if the condition is not satisfied. See section ConditionalRule for more information.	Optional	0 or 1	Container

Element	Description	Required	Multiplicity	Datatype
NavigateGlobal	NavigateGlobal is a subelement of Rules that specifies whether the learner can navigate to this node from anywhere in the activity. If the value is on, learners are permitted to arrive to the current node from anywhere in the activity through a navigation menu. If the value is off, learners will only be able to arrive at this node through links from other nodes.  Valid values are: on, off.	Optional	0 or 1	Restricted

Example:

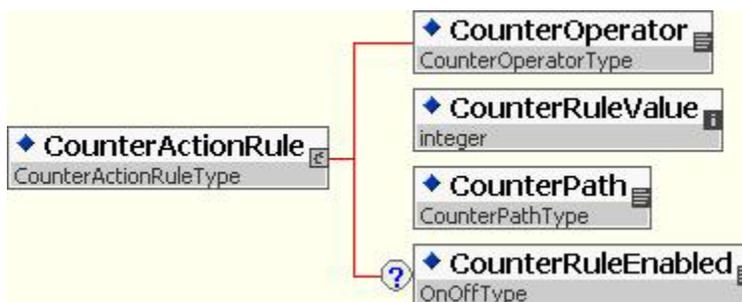
```

<Rules>
  <CounterActionRule> ... </CounterActionRule>
  <Probability> on </Probability>
  <ConditionalRule> ... </ConditionalRule>
  <NavigateGlobal> off </NavigateGlobal>
</Rules>

```

### 8.2.13 CounterActionRule

CounterActionRule works with the numeric counters defined in the properties element. Counters enable a game-like environment where learners can earn or lose points in a certain category based on their actions. CounterActionRule indicates whether to add or subtract value from a counter when a learner enters this node. A rule may be configured for evaluation at some nodes and not others.



## CounterActionRule Element Information

Element	Description	Required	Multiplicity	Datatype
<b>CounterActionRule</b>	CounterActionRule works with a counter defined by the Counter element within the activity model Properties (See section Counter for more information about Counters). It indicates whether to add or subtract value from a numeric counter or to set the counter equal to a set value when a learner enters a node or selects a link.	Optional	0 or more	Container
CounterOperator	CounterOperator is a subelement of CounterActionRule that specifies the operation to be executed. When combined with the CounterRuleValue, it indicates whether to add or subtract value from a numeric counter or to set the counter equal to a set value  Valid values are: +, -, =.	Required	1	Restricted
CounterRuleValue	CounterRuleValue is a subelement of CounterActionRule that indicates the amount to add to or subtract from the counter value or the absolute value to which the counter must be set. CounterRuleValue must be used in conjunction with CounterOperator.	Required	1	Integer
CounterPath	CounterPath is the subelement of CounterActionRule that references the unique identifier for the counter, in the form of an XPath, to which this rule applies. The identifier is defined in an attribute of the Counter element. Valid values have the following format:  <code>/ActivityModel/Properties/Counters/Counter [@id='X']</code>  Where X is the id of the Counter to which this rule applies.	Required	1	Restricted (to conformant XPath)  See section Identifying Data and Resources through XPath for more information.

Element	Description	Required	Multiplicity	Datatype
CounterRuleEnabled	CounterRuleEnabled is the subelement of CounterActionRule that defines whether a counter rule action should be taken if the necessary rule conditions have been met. This enables counter rules to be evaluated selectively, only at relevant activity nodes. Valid values are on and off. The default value is On.	Optional	0 or 1	Restricted

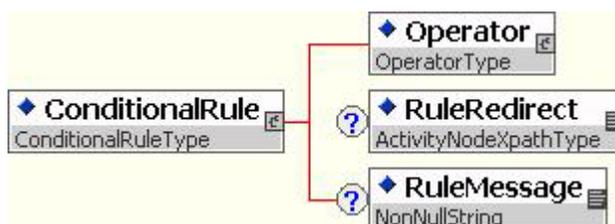
Example:

```
<CounterActionRule>
  <CounterOperator> - </CounterOperator>
  <CounterRuleValue> 10 </CounterRuleValue>
  <CounterPath>
    /ActivityModel/Properties/Counters/Counter[@id = '132']
  </CounterPath>
</CounterActionRule>
```

### 8.2.14 ConditionalRule

ConditionalRule provides a structured mechanism for creating conditions for accessing an activity node. The Boolean expression created must be true in order for the learner to access the activity node. The following are statements that represent conditions one might represent using ConditionalRule.

- If the learner has visited nodes 1 and 2, permit access.
- Permit access only if the learner has not visited node 3 or node 4.
- Permit access only if the learner has visited node 5 or nodes 6 and 7.
- If the learner has visited node 1 and order DiagnosticTest with id 432
- If the learner has not visited node 2 but has visited node 5 and not ordered DiagnosticTest with id 432



## ConditionalRule Element Information

Element	Description	Required	Multiplicity	Datatype
<b>ConditionalRule</b>	ConditionalRule is a subelement of Rules. It contains a subelement that defines a Boolean expression used to determine if entrance to the node is possible. It also contains elements that specify to which node a user is redirected and/or what message to show if the condition is not satisfied.	Optional	0 or 1	Container
<b>Operator</b>	Operator is a subelement of ConditionalRule. It contains subelements that define a Boolean expression used to determine if entrance to the node is possible based on the nodes previously visited and VPD data previously triggered. See section Operator for more information.	Required	1	Container
<b>RuleRedirect</b>	RuleRedirect is a subelement of ConditionalRule that specifies the node to which a learner is redirected once this conditional Rule has not been met. It contains a valid XPath to the activity node in the activity model to which the learner is redirected. If RuleRedirect is absent from the Rule element, no redirection occurs.  The valid values for RuleRedirect are:  <code>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='X']</code>  All in one line, where X is the id of an Activity Node.	Optional	0 or 1	Restricted (to conformant XPath)  See section Identifying Data and Resources through XPath for more information.
<b>RuleMessage</b>	RuleMessage is a subelement of ConditionalRule that defines a message to be shown to the learner when the conditional rule has not been met. The message may inform them that they will be redirected, that the requirement for entering the node were not met, or may provide other feedback to the learner.	Optional	0 or 1	Non-null String

## Example:

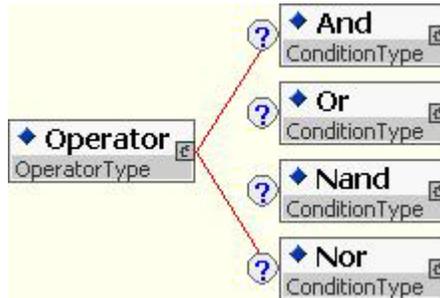
```

<ConditionalRule>
  <Operator> ... </Operator>
  <RuleRedirect>
    /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='43']
  </RuleRedirect>
  <RuleMessage>You forgot to order an important diagnostic
  test!</RuleMessage>
</ConditionalRule>

```

## 8.2.15 Operator

Operator provides the structure to construct a Boolean expression. Operator is a choice element.



The And, Or, Nand, and Nor subelements enable grouping of conditions equivalent to the parentheses commonly used by mathematic representations of Boolean expressions. Here is an example to illustrate the structure of the XML.

For example, the following expression:

(1 and 2) or 5

would be expressed as:

```
<ConditionalRule>
  <Or>
    <Operand>5</Operand>
    <And>
      <Operand>1</Operand>
      <Operand>2</Operand>
    </And>
  </Or>
</ConditionalRule>
```

## Operator Element Description

Element	Description	Required	Multiplicity	Datatype
<b>Operator</b>	Operator is a subelement of ConditionalRule. It contains subelements that define a Boolean expression used to determine if entrance to the node is possible based on the nodes previously visited and VPD data previously triggered.	Required	1	Container
<b>And</b>	And is a subelement of ConditionalRule. And describes a set of ActivityNodes and/or VPD elements that must have been visited or triggered (respectively) to access this ActivityNode. See section ConditionType for more information.	Either And, Or, Nand, or Nor is required.	0 or 1	ConditionType
<b>Or</b>	Or is a subelement of ConditionalRule. Or describes a Boolean statement in which only one of a set of nodes and/or VPD elements must have been visited or triggered (respectively) to access this ActivityNode. See section ConditionType for more information.	Either And, Or, Nand, or Nor is required.	0 or 1	ConditionType
<b>Nand</b>	Nand is a subelement of ConditionalRule. Nand describes a Boolean statement in which multiple nodes and/or VPD elements must <b>not</b> have been visited or triggered (respectively) to access this ActivityNode. See section ConditionType for more information.	Either And, Or, Nand, or Nor is required.	0 or 1	ConditionType

Element	Description	Required	Multiplicity	Datatype
Nor	Nor is a subelement of ConditionalRule. Nor describes a Boolean statement in which only one of a set of nodes and/or VPD elements must <b>not</b> have been visited or triggered (respectively) to access this ActivityNode. See section ConditionType for more information.	Either And, Or, Nand, or Nor is required.	0 or 1	ConditionType

Example:

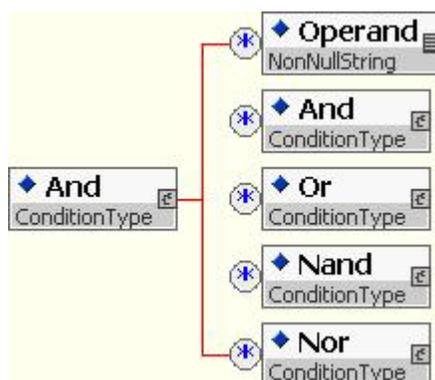
```

<Operator>
  <And>
    <Operand>
      /VirtualPatientData/InterviewItem[@id = '6']
    </Operand>
    <Operand>
      /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id = '1']
    </Operand>
    <Nor>
      <Operand>
        /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id = '2']
      </Operand>
      <Operand>
        /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id = '3']
      </Operand>
    </Nor>
  </And>
</Operator>

```

## 8.2.16 ConditionType

The ConditionType is used to define the And, Or, Nand, and Nor elements. ConditionType is used to create Boolean statements which must be true for a learner to access an activity node.



## ConditionType Element Information

Element	Description	Required	Multiplicity	Datatype
Operand	<p>Operand references the unique identifier, in the form on an XPath, of an ActivityNode or a VPD element.</p> <p>If And is the parent element, Operand defines a node that must have been visited and/or a VPD element that must have been triggered (respectively) for the statement to be true.</p> <p>If Or is the parent element, Operand defines one of a set of nodes and/or VPD elements, one of which must have been visited or triggered (respectively) for the statement to be true.</p> <p>If Nand is the parent element, Operand defines a set of nodes and/or VPD elements that must <b>not</b> have been visited or triggered (respectively) for the statement to be true.</p> <p>If Nor is the parent element, Operand defines a set of nodes and/or VPD elements, one of which must <b>not</b> have been visited or triggered (respectively) for the statement to be true.</p>	Optional	0 or more	Non-null String
<b>And</b>	And describes a set of ActivityNodes and/or VPD elements that must have been visited or triggered (respectively) for this Boolean statement to be true.	Optional	0 or more	ConditionType
<b>Or</b>	Or describes a Boolean statement in which only one of a set of nodes and/or VPD elements must have been visited or triggered (respectively) for the statement to be true.	Optional	0 or more	ConditionType

Element	Description	Required	Multiplicity	Datatype
<b>Nand</b>	Nand describes a Boolean statement in which multiple nodes and/or VPD element must <b>not</b> have been visited or triggered (respectively) for the statement to be true.	Optional	0 or more	ConditionType
<b>Nor</b>	Nor describes a Boolean statement in which only one of a set of nodes and/or VPD elements must <b>not</b> have been visited or triggered (respectively) for the statement to be true.	Optional	0 or more	ConditionType

Example:

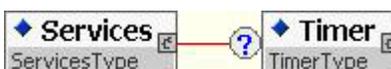
```

<And>
  <Operand>/VirtualPatientData/InterviewItem[@id = '6']</Operand>
  <Operand>/VirtualPatientData/DiagnosticTest[@id = '7']</Operand>
  <Or>
    <Operand>/VirtualPatientData/PhysicalExam[@id = '7']</Operand>
    <Operand>
      /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id = '1']
    </Operand>
  </Or>
</And>

```

## 8.2.17 Services

Services allows a timer to be implemented for an activity node.



### Services Element Description

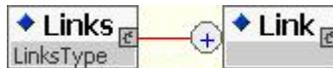
Element	Description	Required	Multiplicity	Datatype
<b>Services</b>	Services is a subelement of ActivityNode. It allows for the definition of a real-time timer for this ActivityNode.	Optional	0 or 1	Container
<b>Timer</b>	Timer contains subelements that allow for the definition of a real-time timer for this ActivityNode. See section Timer for more information.	Optional	0 or 1	Container

Example:

```
<Services>
  <Timer> ... </Timer>
</Services>
```

## 8.2.18 Links

Links define how one ActivityNode connects to other ActivityNodes to create a path through the learning activity.



### Links Element Description

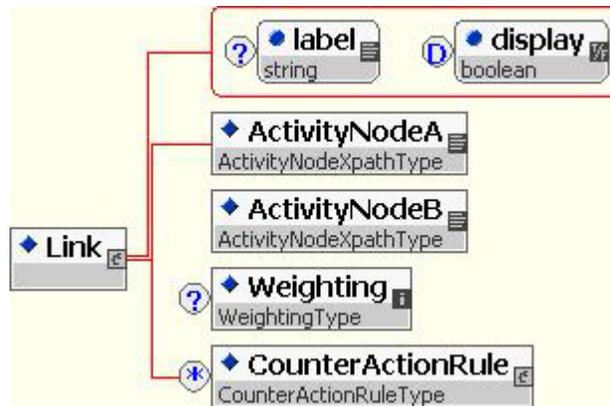
Element	Description	Required	Multiplicity	Datatype
<b>Links</b>	Links is a subelement of ActivityModel that defines how one ActivityNode links to another to create a path through the learning activity.	Optional	0 or 1	Container
<b>Link</b>	Link is a subelement of Links that describes a unidirectional link from one ActivityNode to another. See section Link for more information.	Required	1 or more	Container

Example:

```
<Links>
  <Link> ... </Link>
  <Link> ... </Link>
  <Link> ... </Link>
  <Link> ... </Link>
  <Link> ... </Link>
</Links>
```

## 8.2.19 Link

Link describes a unidirectional link from one Activity Node to another, including the label used for the link and probabilistic weighting.



Link Element Description

Element	Description	Required	Multiplicity	Datatype
Link	<p>Link is a subelement of Links that describes a unidirectional link from one ActivityNode to another.</p> <p>Link has the following attributes:</p> <p><i>label</i> A text label that the virtual patient player uses to present the link to the learner.</p> <p><i>display</i> Indicates whether or not the virtual patient player should display the label for the link. Valid values are true and false. True is the default value.</p>	Required	1 or more	Container
ActivityNodeA	<p>ActivityNodeA is the subelement of Link that references the identifier, in the form of an XPath, of an ActivityNode that serves as the starting point for the link. ActivityNodeA links to ActivityNodeB.</p> <p>ActivityNodeA has the following format: /ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=' X' ]</p> <p>All in one line, where X is the id of an Activity Node.</p>	Required	1	Restricted (to conformant XPath)  See section Identifying Data and Resources through XPath for more information

Element	Description	Required	Multiplicity	Datatype
ActivityNodeB	<p>ActivityNodeB is the subelement of Link that references the identifier, in the form of an XPath, of an ActivityNode that serves as the ending point for the link. ActivityNodeA links to ActivityNodeB.</p> <p>ActivityNodeB has the following format:</p> <pre>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='X']</pre> <p>All in one line, where X is the id of an Activity Node.</p>	Required	1	Restricted (to conformant XPath)  See section Identifying Data and Resources through XPath for more information
Weighting	<p>Weighting is a subelement of Link that gives the percent chance that the link will be displayed. Probabilistic weighting may be turned off at the activity node using the Probability element. Note the sum of all the weighting elements of links leaving a particular node should equal to 100.</p>	Optional	0 or 1	Integer below 100
CounterActionRule	<p>CounterActionRule is a subelement of Link. CounterActionRule works with a counter defined by the Counter element within the activity model Properties (See section Counter for more information about Counters). It indicates whether to add or subtract value from a numeric counter or to set the counter equal to a set value when a learner selects this link. See section CounterActionRule for more information.</p>	Optional	0 or more	Container

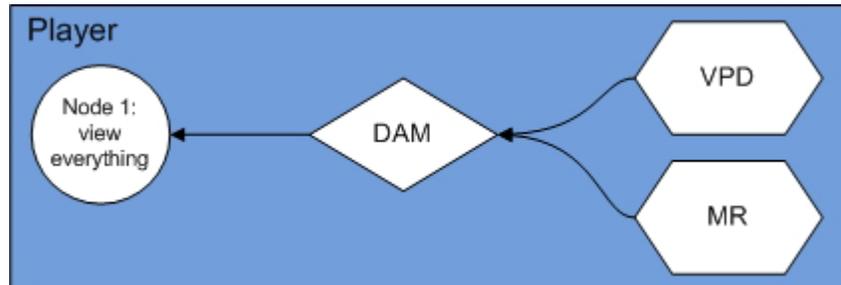
Example:

```
<Link label="Do surgery" display="on">
  <ActivityNodeA> A2342 </ActivityNodeA>
  <ActivityNodeB> A5435 </ActivityNodeB>
  <Weighting> 80 </Weighting>
</Link>
```

### 8.3 Activity Model Topology

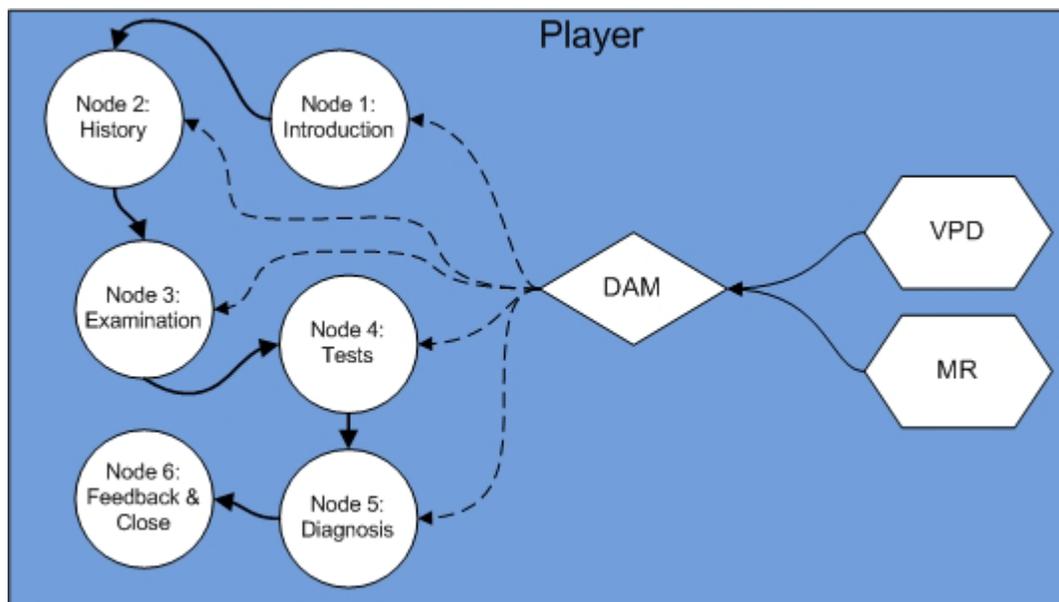
Extrapolating from the many different use cases and exemplar applications presented by working group members, the MVP AM is modeled around a number of ‘activity nodes’, each of which can contain a variety of different content and kinds of interaction. The options and paths the user can take are determined by links between these nodes. The ways in which these nodes and links are presented to the user are defined by a system of rules.

Topologically we can identify three kinds of node-based activity models that represent the majority of virtual patient applications: unitary, linear and branching - as shown in the following figures.



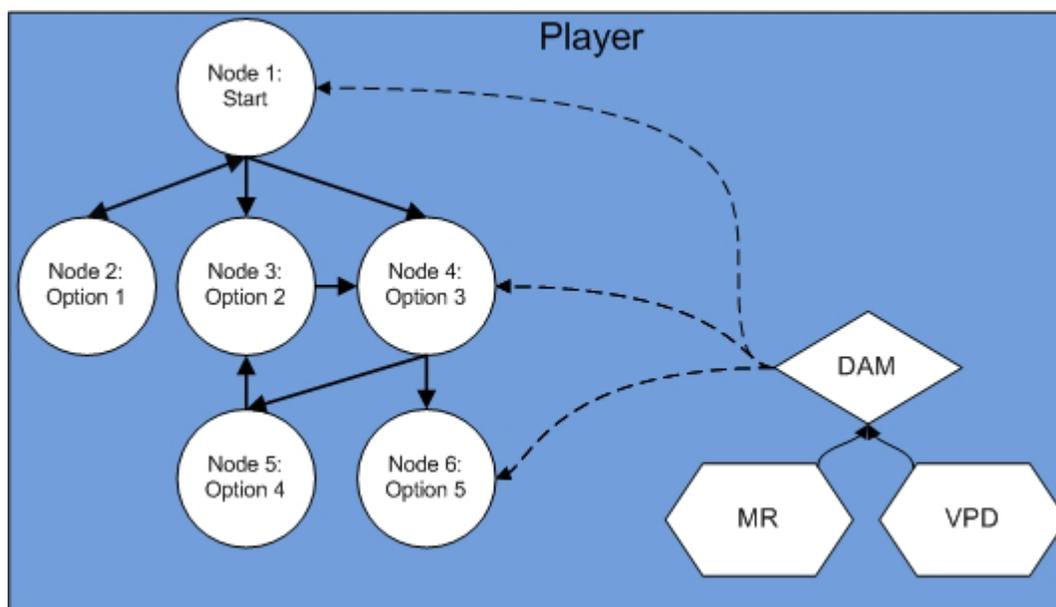
**Figure 8: Unitary Activity**

Figure 8 shows a Unitary activity in which the user accesses virtual patient data and media resources from a single node (using the data availability model to pair them). This kind of activity model could be reified as an electronic patient record, a web page with links to all the relevant materials or as a PDF of all the necessary information for a PBL activity. The player acts as a gateway/aggregator for the other components.



**Figure 9: Linear Activity**

Figure 9 shows a linear activity in which the user is presented with a series of linear steps, for instance in a consultation environment. The user moves through the steps and interactions presented. A progressive disclosure player for PBL would follow this model.



**Figure 10: Branching Activity**

Figure 10 shows a branching activity in which the user negotiates a decision tree. The user makes decisions which options/branches to pursue, their path depends on the consequences of these decisions. Many virtual patients will be a combination of branching and linear activities.

Within an activity some user interactions may be presented within a node while others may be presented as discrete nodes. As a rule of thumb each node should advance the activity. For instance the responses within a multiple-choice question or a patient interaction (connecting with the VPD) would typically be processed within a node while making a decision such as choosing whether to take a history or examine a patient would be represented by separate linked nodes.

In addition to the basic node and link topology there has been a need expressed for dividing the nodes into arbitrary sections, for instance into sections that follow the history + examination + investigations format. This can be managed by collecting node references into NodeSection elements as follows:

```
<NodeSection id="S1" label="history">
  <ActivityNode id="N1" label="start" >
    .
    .
    .
  </ActivityNode>
  <ActivityNode id="N2" label="option 1" >
    .
    .
    .
  </ActivityNode>
</NodeSection>
<NodeSection id="S2" label="examination">
  <ActivityNode id="N3" label="option 2" >
    .
    .
    .
  </ActivityNode>
  <ActivityNode id="N4" label="option 3" >
```

```
. . .
</ActivityNode>
<ActivityNode id="N5" label="option 4" >
. . .
</ActivityNode>
</NodeSection>
<NodeSection id="3" label="investigations">
  <ActivityNode id="N6" label="option 6" >
. . .
</ActivityNode>
  <ActivityNode id="N7" label="option 6" >
. . .
</ActivityNode>
</NodeSection>
```

## 8.4 Sample Activity Model

Putting topology, rule and service elements together allows a highly expressive and adaptable framework for the MVP Activity Model to be put together. The following is an extended code snip that demonstrates the following features:

- There are two sections containing nodes 1, 2 and 3 and 4, 5 and 6 respectively
- A score of 'available funds' is instantiated and changed at nodes 2 (subtract 100) and 3 (add 50)
- Node 1 has probability turned on and will call the weightings for links from node 1
- Node 4 has a conditional rule that requires the user to have already visited either node 2 or node 3. If the user has not visited node 2 or 3 they are redirected to node 6.

```
<?xml version = "1.0" encoding = "UTF-8"?>
<ActivityModel xmlns = "http://ns.medbiq.org/activitymodel/v1/" xmlns:xsi
= "http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation =
"http://ns.medbiq.org/activitymodel/v1/
file:///C:/Documents%20and%20Settings/vsmothers.CTSNET/My%20Documents/Xml/
virtualpatient_development/activitymodel.xsd">
  <Properties>
    <Counters>
      <Counter>
        <Counter id = "A">
          <CounterLabel>available funds</CounterLabel>
          <CounterUnitsSuffix>dollars</CounterUnitsSuffix>
          <CounterUnitsPrefix>$</CounterUnitsPrefix>
          <CounterInitValue>1000</CounterInitValue>
          <CounterRules>
            <Rule>
              <Relation>leq</Relation>
              <Value>0</Value>
              <RuleRedirect>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id =
'99']</RuleRedirect>
                <RuleMessage>You have run out of funds, try
again!</RuleMessage>
              </Rule>
            </CounterRules>
          </Counter>
        </Counters>
      </Properties>
    <ActivityNodes>
      <NodeSection id = "S1" label = "part 1">
        <ActivityNode id = "1" label = "start">
          <Content>/DataAvailabilityModel/DAMNode[@id = '1']</Content>
          <Rules>
            <Probability>On</Probability>
          </Rules>
        </ActivityNode>
        <ActivityNode id = "2" label = "option 2">
          <Content>/DataAvailabilityModel/DAMNode[@id = '2']</Content>
```

```

    <Rules>
      <CounterActionRule>
        <CounterOperator>-</CounterOperator>
        <CounterRuleValue>100</CounterRuleValue>

    <CounterPath>/ActivityModel/Properties/Counters/Counter[@id =
'A']</CounterPath>
      </CounterActionRule>
    </Rules>
  </ActivityNode>
  <ActivityNode id = "3" label = "option 3">
    <Content>/DataAvailabilityModel/DAMNode[@id = '3']</Content>
    <Rules>
      <CounterActionRule>
        <CounterOperator>+</CounterOperator>
        <CounterRuleValue>50</CounterRuleValue>

    <CounterPath>/ActivityModel/Properties/Counters/Counter[@id =
'A']</CounterPath>
      </CounterActionRule>
    </Rules>
  </ActivityNode>
</NodeSection>
<NodeSection id = "S2" label = "part 2">
  <ActivityNode id = "4" label = "option 4">
    <Content>/DataAvailabilityModel/DAMNode[@id = '4']</Content>
    <Rules>
      <ConditionalRule>
        <Operator>
          <Or>

            <Operand>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id =
'2']</Operand>

            <Operand>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id =
'3']</Operand>

          </Or>
        </Operator>

      <RuleRedirect>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id
= '6']</RuleRedirect>
    </ConditionalRule>
  </Rules>
</ActivityNode>
  <ActivityNode id = "5" label = "option 5">
    <Content>/DataAvailabilityModel/DAMNode[@id = '3']</Content>
  </ActivityNode>
  <ActivityNode id = "6" label = "option 6">
    <Content>/DataAvailabilityModel/DAMNode[@id = '3']</Content>
  </ActivityNode>
</NodeSection>
</ActivityNodes>

```

```
<Links>
  <Link label = "Lorem Ipsum" display = "true">
    <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='1']</ActivityNodeA>
    <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='2']
</ActivityNodeB>
    <Weighting> 25 </Weighting>
  </Link>
  <Link label = "Lorem Ipsum" display = "true">
    <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='1']
    </ActivityNodeA>
    <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='3']
    </ActivityNodeB>
    <Weighting> 45 </Weighting>
  </Link>
  <Link label = "Lorem Ipsum" display = "true">
    <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='1']
    </ActivityNodeA>
    <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='4']
    </ActivityNodeB>
    <Weighting> 30 </Weighting>
  </Link>
  <Link label = "Lorem Ipsum" display = "true">
    <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='2']
    </ActivityNodeA>
    <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='1']
    </ActivityNodeB>
  </Link>
  <Link label = "Lorem Ipsum" display = "true">
    <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='3']
    </ActivityNodeA>
    <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='4']
    </ActivityNodeB>
  </Link>
  <Link label = "Lorem Ipsum" display = "true">
    <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='4']
    </ActivityNodeA>
    <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='5']
    </ActivityNodeB>
  </Link>
```

```

    <Link label = "Lorem Ipsum" display = "true">
      <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='4']
      </ActivityNodeA>
      <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='6']
      </ActivityNodeB>
    </Link>
    <Link label = "Lorem Ipsum" display = "true">
      <ActivityNodeA>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='5']
      </ActivityNodeA>
      <ActivityNodeB>
/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='3']
      </ActivityNodeB>
    </Link>
  </Links> </ActivityModel>

```

## 8.5 Using the Activity Model and Other MVP Components

The MVP architecture consists of five components. Because the Activity Model describes what the user can and cannot do, it is the component through which the virtual patient data, media resources, and data availability model components are expressed.

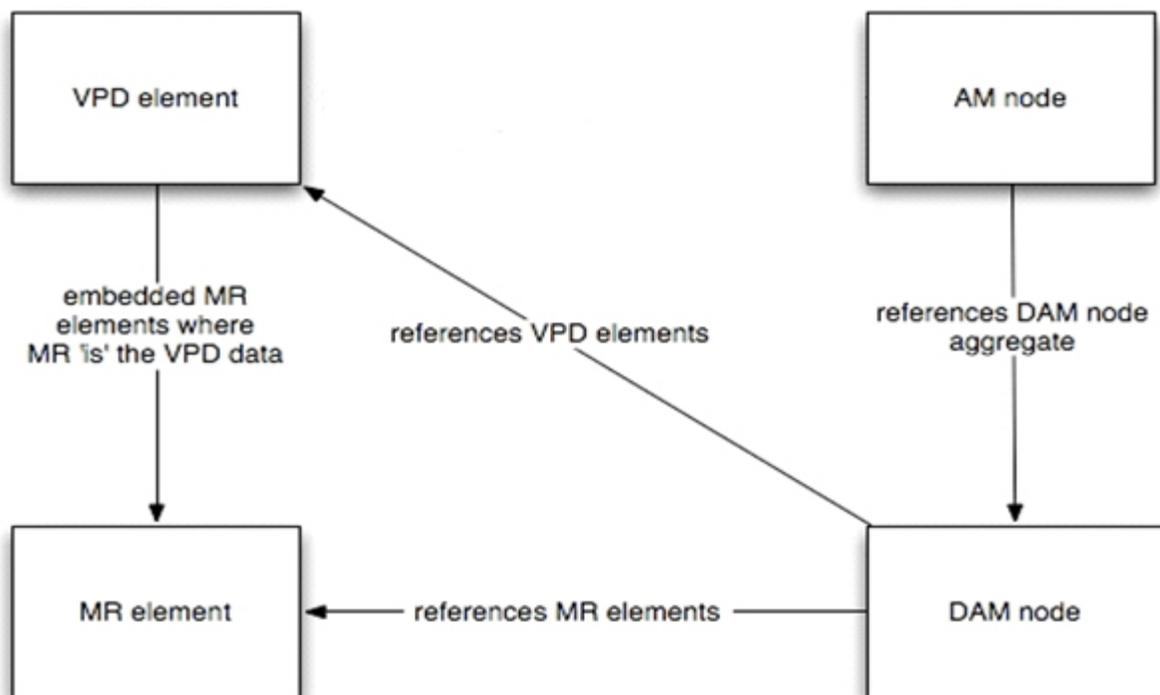


Figure 11: The Activity Model and Other MVP components

Figure 11 shows how the activity model brings together media and virtual patient data through references to the data availability model.

The Data Availability Model acts as a simple aggregation and bridging mechanism to group elements from the MR and VPD collections within an MVP and connect them with the AM. Each DAM aggregate is represented as a DAMNode with a unique ID within the current MVP. Note that the DAM does not reference the activity model, rather the activity model references nodes in the DAM.

## 9 Conformance

To be a conformant instance of MedBiquitous Virtual Patient, a content package:

- Shall contain virtual patient data, activity model, and data availability model XML documents that validate against the MedBiquitous Virtual Patient (ANSI /MEDBIQ VP.10.1-200x) XML schemas available at [http://ns.medbiq.org/virtualpatientdata/v1/virtualpatient\\_schemas.zip](http://ns.medbiq.org/virtualpatientdata/v1/virtualpatient_schemas.zip)
- Shall be a conforming XML instance of a SCORM 2004 4th Edition Resource Content Package Application Profile or Content Aggregation Content Package Application Profile
- Shall conform to any additional requirements stated in this specification (see 5.2.3 VPDText, 6.1 Media Resource Foundations, 6.2.2 Organizations, 6.2.3 Resources, 6.2.3.1 Referencing within a Manifest, 7.2.3 DAMNodeItem, 8.2.6 Rule, 8.2.11 ActivityNode, 8.2.14 ConditionalRule, 8.2.16 ConditionType, 8.2.19 Link)
- May include elements not defined in this document only by using the XtensibleInfo container element defined in the section XtensibleInfo.

## 10 Other Schema Referenced

The lom element and credits datatype are imported from Healthcare LOM, and text describing these can be found in the specification document, available for download at:

[http://www.medbiq.org/working\\_groups/learning\\_objects/HealthcareLOMSpecification.pdf](http://www.medbiq.org/working_groups/learning_objects/HealthcareLOMSpecification.pdf)

Schemas are available for download from the MedBiquitous XML Repository at

<http://www.medbiq.org/repository>.

## 11 Sample XML Documents

### 11.1 A Branching Example

The following examples show XML from a text-based branching system, vpSim, courtesy JB McGee, University of Pittsburgh.

#### manifest.xml

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:adlcp="http://www.adlnet.org/xsd/adlcp_v1p3"
xsi:schemaLocation="http://www.imsglobal.org/xsd/imscp_v1p1 imscp_v1p1.xsd
http://www.adlnet.org/xsd/adlcp_v1p3 adlcp_v1p3.xsd" identifier="vpSim"
version="0.1" xmlns="http://www.imsglobal.org/xsd/imscp_v1p1">
  <metadata>
    <schema>ADL SCORM</schema>
    <schemaversion>2004, 4th edition</schemaversion>
  </metadata>
  <organizations default="ID_1">
    <organization identifier="ID_1" structure="hierarchical">
      <title>University of Pittsburgh School of Medicine</title>
      <item identifier="ID_2" identifierref="r1">
        <title>35 year old woman with cough and fever</title>
        <metadata>
          <adlcp:location>metadata.xml</adlcp:location>
        </metadata>
      </item>
    </organization>
  </organizations>
  <resources>
    <resource identifier="r1" type="webcontent" adlcp:scormType="sco"
href="launchvp.html">
      <file href="launchvp.html" />
      <dependency identifierref="r2" />
      <dependency identifierref="r3" />
      <dependency identifierref="r4" />
      <dependency identifierref="r5" />
      <dependency identifierref="r6" />
      <dependency identifierref="r7" />
      <dependency identifierref="r8" />
    </resource>
    <resource identifier="r2" type="webcontent" adlcp:scormType="asset"
href="VPplayer.swf">
      <file href="VPplayer.swf" />
    </resource>
    <resource identifier="r3" type="webcontent" adlcp:scormType="asset"
href="activitymodel.xml">
      <file href="activitymodel.xml" />
    </resource>
    <resource identifier="r4" type="webcontent" adlcp:scormType="asset"
href="virtualpatientdata.xml">
```

```

    <file href="virtualpatientdata.xml" />
  </resource>
  <resource identifier="r5" type="webcontent" adlcp:scormType="asset"
href="dataavailabilitymodel.xml">
    <file href="dataavailabilitymodel.xml" />
  </resource>
  <resource identifier="r6" type="webcontent" adlcp:scormType="asset"
href="imsmanifest.xml">
    <file href="imsmanifest.xml" />
  </resource>
  <resource identifier="r7" type="webcontent" adlcp:scormType="asset"
href="MediaFiles/patientphoto.jpg">
    <file href="MediaFiles/patientphoto.jpg" />
  </resource>
  <resource identifier="r8" type="webcontent" adlcp:scormType="asset"
href="MediaFiles/pneumoniaxray.jpg">
    <file href="MediaFiles/pneumoniaxray.jpg" />
  </resource>
</resources>
</manifest>

```

### virtualpatientdata.xml

```

<?xml version="1.0" encoding="utf-8"?>
<VirtualPatientData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/virtualpatientdata/v1/
virtualpatientdata.xsd" xmlns="http://ns.medbiq.org/virtualpatientdata/v1/">
  <VPDText id="v1" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">Mrs. Greer presents to your
office complaining of a deep cough and a high fever.
"Doctor, the coughing is so bad that I can't sleep. What is wrong with
me?"</div>
  </VPDText>
  <VPDText id="v2" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">History</div>
  </VPDText>
  <VPDText id="v3" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">Diagnostic tests</div>
  </VPDText>
  <VPDText id="v4" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">Differential Diagnosis</div>
  </VPDText>
  <VPDText id="v5" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">Mrs Greer is gravely ill.
Admitting her is a good idea. Thank you for taking care of the patient!</div>
  </VPDText>
  <VPDText id="v6" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">Mrs. Greer is gravely ill. Your
decision is a bad one and would cause harm. Start over.</div>
  </VPDText>
  <VPDText id="v7" textType="narrative">
    <div xmlns="http://www.w3.org/1999/xhtml">Mrs. Greer`s most recent x-ray
shows pneumonia in the lower lobe of the right lung. Oxygen saturation levels
are 85%, RBC is low, WBC is high.</div>
  </VPDText>
  <VPDText id="v8" textType="narrative">

```

```
<div xmlns="http://www.w3.org/1999/xhtml">Blood cell count and oxygen
saturation</div>
</VPDText>
<VPDText id="v9" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Proceed</div>
</VPDText>
<VPDText id="v10" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Mrs Greer is pale, heart rate
115, blood pressure 65 over 100. You hear crackling in the lower lobe of the
right lung.</div>
</VPDText>
<VPDText id="v25" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Asthma</div>
</VPDText>
<VPDText id="v26" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Viral Pneumonia</div>
</VPDText>
<VPDText id="v27" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Bacterial Pneumonia</div>
</VPDText>
<VPDText id="v28" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Asthma is not typically
accompanied by high fever. based on her age, bacterial pneumonia is most
likely.</div>
</VPDText>
<VPDText id="v29" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Viral pneumonia is less likely
than bacterial pneumonia generally in patients of this age.</div>
</VPDText>
<VPDText id="v30" textType="narrative">
  <div xmlns="http://www.w3.org/1999/xhtml">Bacterial pneumonia is most
common in an otherwise healthy patient of this age.</div>
</VPDText>
<InterviewItem id="i1:inquiry">
  <Question>How long has this been going on?</Question>
  <Response>About a week. I woke up after a trip overseas and felt
horrible.</Response>
</InterviewItem>
<InterviewItem id="i2:inquiry">
  <Question>Are you experiencing any pain?</Question>
  <Response>Yes, it hurts to breathe deeply.</Response>
</InterviewItem>
<InterviewItem id="i3:inquiry">
  <Question>Why did you wait so long to see me?</Question>
  <Response>Gosh, if you're going to talk to me like that maybe I should
find another doctor.</Response>
</InterviewItem>
</VirtualPatientData>
```

**dataavailabilitymodel.xml**

```

<?xml version="1.0" encoding="utf-8"?>
<DataAvailabilityModel xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/dataavailabilitymodel/v1/
dataavailabilitymodel.xsd"
xmlns="http://ns.medbiq.org/dataavailabilitymodel/v1/">
  <DAMNode id="d0">
    <DAMNodeLabel>Asthma is not typically accompanied by high fever. based on
her age, bacterial pneumonia is most likely.</DAMNodeLabel>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/VPDText[@id = 'v28']</ItemPath>
    </DAMNodeItem>
  </DAMNode>
  <DAMNode id="d1">
    <DAMNodeLabel>Viral pneumonia is less likely than bacterial pneumonia
generally in patients of this age.</DAMNodeLabel>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/VPDText[@id = 'v29']</ItemPath>
    </DAMNodeItem>
  </DAMNode>
  <DAMNode id="d2">
    <DAMNodeLabel>Bacterial pneumonia is most common in an otherwise healthy
patient of this age.</DAMNodeLabel>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/VPDText[@id = 'v30']</ItemPath>
    </DAMNodeItem>
  </DAMNode>
  <DAMNode id="DM1">
    <DAMNodeLabel>Start your case here</DAMNodeLabel>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/VPDText[@id = 'v1']</ItemPath>
      <ItemOrder>0</ItemOrder>
    </DAMNodeItem>
    <DAMNodeItem display="immediately">
      <ItemPath>/manifest/resources/resource[@identifier = 'r7']</ItemPath>
      <ItemOrder>1</ItemOrder>
    </DAMNodeItem>
  </DAMNode>
  <DAMNode id="DM2">
    <DAMNodeLabel>History</DAMNodeLabel>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/VPDText[@id = 'v2']</ItemPath>
      <ItemOrder>0</ItemOrder>
    </DAMNodeItem>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/InterviewItem[@id =
'i1:inquiry']</ItemPath>
      <ItemOrder>1</ItemOrder>
    </DAMNodeItem>
    <DAMNodeItem display="ontrigger">
      <ItemPath>/VirtualPatientData/InterviewItem[@id =
'i2:inquiry']</ItemPath>
      <ItemOrder>2</ItemOrder>
    </DAMNodeItem>
    <DAMNodeItem display="ontrigger">

```

```

    <ItemPath>/VirtualPatientData/InterviewItem[@id =
'13:inquiry']</ItemPath>
    <ItemOrder>3</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM3">
  <DAMNodeLabel>Diagnostic tests</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v3']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM4">
  <DAMNodeLabel>Differential Diagnosis</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v4']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
  <DAMNodeItem display="immediately">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v25']</ItemPath>
    <ItemComment>/DataAvailabilityModel/DAMNode[@id = 'd0']</ItemComment>
    <ItemOrder>1</ItemOrder>
  </DAMNodeItem>
  <DAMNodeItem display="immediately">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v26']</ItemPath>
    <ItemComment>/DataAvailabilityModel/DAMNode[@id = 'd1']</ItemComment>
    <ItemOrder>2</ItemOrder>
  </DAMNodeItem>
  <DAMNodeItem display="immediately">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v27']</ItemPath>
    <ItemComment>/DataAvailabilityModel/DAMNode[@id = 'd2']</ItemComment>
    <ItemOrder>3</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM5">
  <DAMNodeLabel>Admit patient</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v5']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM6">
  <DAMNodeLabel>Bad idea</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v6']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM7">
  <DAMNodeLabel>Chest Xray, blood cell count, and oxygen
saturation</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v7']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
  <DAMNodeItem display="immediately">
    <ItemPath>/manifest/resources/resource[@identifier = 'r8']</ItemPath>

```

```

    <ItemOrder>1</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM8">
  <DAMNodeLabel>Blood cell count and oxygen saturation</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v8']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM9">
  <DAMNodeLabel>Proceed</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v9']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
</DAMNode>
<DAMNode id="DM10">
  <DAMNodeLabel>Physical Exam</DAMNodeLabel>
  <DAMNodeItem display="ontrigger">
    <ItemPath>/VirtualPatientData/VPDText[@id = 'v10']</ItemPath>
    <ItemOrder>0</ItemOrder>
  </DAMNodeItem>
</DAMNode>
</DataAvailabilityModel>

```

## activitymodel.xml

```

<?xml version="1.0" encoding="utf-8"?>
<ActivityModel xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/activitymodel/v1/ activitymodel.xsd"
xmlns="http://ns.medbiq.org/activitymodel/v1/">
  <ActivityNodes>
    <NodeSection id="NS1" label="35 year old woman with cough and fever">
      <ActivityNode id="AN1" label="Start your case here">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM1']</Content>
      </ActivityNode>
      <ActivityNode id="AN2" label="History">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM2']</Content>
      </ActivityNode>
      <ActivityNode id="AN3" label="Diagnostic tests">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM3']</Content>
      </ActivityNode>
      <ActivityNode id="AN4" label="Differential Diagnosis">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM4']</Content>
      </ActivityNode>
      <ActivityNode id="AN5" label="Admit patient">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM5']</Content>
      </ActivityNode>
      <ActivityNode id="AN6" label="Bad idea">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM6']</Content>
      </ActivityNode>
      <ActivityNode id="AN7" label="Chest Xray, blood cell count, and oxygen
saturation">
        <Content>/DataAvailabilityModel/DAMNode[@id = 'DM7']</Content>
      </ActivityNode>

```

```

    <ActivityNode id="AN8" label="Blood cell count and oxygen saturation">
      <Content>/DataAvailabilityModel/DAMNode[@id = 'DM8']</Content>
    </ActivityNode>
    <ActivityNode id="AN9" label="Proceed">
      <Content>/DataAvailabilityModel/DAMNode[@id = 'DM9']</Content>
    </ActivityNode>
    <ActivityNode id="AN10" label="Physical Exam">
      <Content>/DataAvailabilityModel/DAMNode[@id = 'DM10']</Content>
    </ActivityNode>
  </NodeSection>
</ActivityNodes>
<Links>
  <Link label="Take history">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN1
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN2
']</ActivityNodeB>
  </Link>
  <Link label="Perform Exam">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN2
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN1
0']</ActivityNodeB>
  </Link>
  <Link label="Blood cell count and oxygen saturation">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN3
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN8
']</ActivityNodeB>
  </Link>
  <Link label="Chest Xray, blood cell count, oxygen saturation.">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN3'
]</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN7'
]</ActivityNodeB>
  </Link>
  <Link label="Stress test">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN3'
]</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN6'
]</ActivityNodeB>
  </Link>
  <Link label="Continue">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN4
']</ActivityNodeA>

```

```
<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN9
']</ActivityNodeB>
  </Link>
  <Link label="Admit patient">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN7
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN5
']</ActivityNodeB>
  </Link>
  <Link label="Make a diagnosis">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN7
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN4
']</ActivityNodeB>
  </Link>
  <Link label="Select drug therapy and schedule 2 week followup">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN7
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN6
']</ActivityNodeB>
  </Link>
  <Link label="Admit patient">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN8
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN5
']</ActivityNodeB>
  </Link>
  <Link label="Make a diagnosis">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN8'
]</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN4'
]</ActivityNodeB>
  </Link>
  <Link label="Select drug therapy and schedule 2 week followup">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN8
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN6
']</ActivityNodeB>
  </Link>
  <Link label="Admit patient">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN9
']</ActivityNodeA>
```

```

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN5
']</ActivityNodeB>
  </Link>
  <Link label="Make diagnosis">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN9
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN4
']</ActivityNodeB>
  </Link>
  <Link label="Refer for diagnostic tests">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN9
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN3
']</ActivityNodeB>
  </Link>
  <Link label="Select drug therapy and schedule 2 week followup">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN9
']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id=AN6 '
']</ActivityNodeB>
  </Link>
  <Link label="Continue">

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN1
0']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='AN9
']</ActivityNodeB>
  </Link>
</Links>
</ActivityModel>

```

## 11.2 A Linear Example

Example

### virtualpatientdata.xml

```

<VirtualPatientData xmlns="http://ns.medbiq.org/virtualpatientdata/v1/"
xmlns:vpd="http://ns.medbiq.org/virtualpatientdata/v1/"
xmlns:websp="http://patientcases.org/medbiq/vpd-extensions/"
xmlns:xhtml="http://www.w3.org/1999/xhtml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/virtualpatientdata/v1/
virtualpatientdata.xsd">
  <vpd:PatientDemographics id="strKey_PatientDemo">
    <vpd:CoreDemographics id="strKey_CoreDemo">
      <vpd:PatientID>1231154751268</vpd:PatientID>
      <vpd:Name>Tom P Miller(reference case)</vpd:Name>
      <vpd:Age>P26Y</vpd:Age>

```

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```
<vpd:Sex>Male</vpd:Sex>
</vpd:CoreDemographics>
</vpd:PatientDemographics>
<vpd:VPDText textType="chief complaint">
  <xhtml:div>This patient has come to see you today because he has a
fever and feels "terrible".</xhtml:div>
</vpd:VPDText>
<vpd:InterviewItem id="1231154751391">
  <vpd:Question>Are you taking medications?</vpd:Question>
  <vpd:Response>I'm not taking any medication. I may take some aspirin
here and there when I get a headache.</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154751888">
  <vpd:Question>Do you feel short of breath easily?</vpd:Question>
  <vpd:Response>I've been feeling short of breath when I exert myself. I
can usually run 5 miles no problem... but today, climbing the stairs to the 3rd
floor made me short of breath!</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154751789">
  <vpd:Question>Do you suffer from high blood pressure?</vpd:Question>
  <vpd:Response>I've never been diagnosed with high blood
pressure.</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154752167">
  <vpd:Question>How has your appetite been lately?</vpd:Question>
  <vpd:Response>I've lost my appetite. I'm not throwing up or feeling
nausea, I'm just not hungry. I have been drinking a lot of liquids
though.</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154752923">
  <vpd:Question>Have you had any recent cold or flu like
symptoms?</vpd:Question>
  <vpd:Response>I don't think I have a cold at the moment. I did have
some flu-like symptoms 2 weeks ago, but maybe I was just
tired.</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154753044">
  <vpd:Question>Have you noticed any lumps in your
breasts?</vpd:Question>
  <vpd:Response>not relevant, male</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154753220">
  <vpd:Question>Do you have problems with your lungs?</vpd:Question>
  <vpd:Response>No, usually not but now I've been coughing day and night
for the past 3 days.</vpd:Response>
</vpd:InterviewItem>
<vpd:InterviewItem id="1231154753906">
  <vpd:Question>Have you had any fever?</vpd:Question>
  <vpd:Response>I've had spiking fevers for 3 days now, I took my
temperature with my home thermometer and it's been as high as 103 degrees. It
comes down when I take tylenol but its never below 100.</vpd:Response>
</vpd:InterviewItem>
<vpd:PhysicalExam id="1231154760389">
  <vpd:ExamName>Percussion test on the back</vpd:ExamName>
  <vpd:LocationOnBody>
    <vpd:BodyPart>back</vpd:BodyPart>
    <vpd:FrontOrBack>Back</vpd:FrontOrBack>
```

```
</vpd:LocationOnBody>
<vpd:Action>percussion</vpd:Action>
<vpd:Finding>Normal percussion sounds over the right lung, dullness to
percussion at the left lungbase.</vpd:Finding>
<vpd:Description>n/a</vpd:Description>
<vpd:Media>

<vpd:MediaPath>/manifest/resources/resource[@identifier='MM_8f72bc64ad5322
eeldb12fed1d4d3f9e']</vpd:MediaPath>

<vpd:Location>media/CASE_IMAGES/tpl_male_25to40y/Physical_Examination/MEDI
A/inspection/backDorsalis.jpg</vpd:Location>
</vpd:Media>
</vpd:PhysicalExam>
<vpd:PhysicalExam>
<vpd:ExamName>Auscultation of left 4th interspace near the
sternum</vpd:ExamName>
<vpd:LocationOnBody>
<vpd:BodyPart>chest</vpd:BodyPart>
<vpd:RightOrLeft>Left</vpd:RightOrLeft>
<vpd:FrontOrBack>Front</vpd:FrontOrBack>
</vpd:LocationOnBody>
<vpd:Action>auscultation</vpd:Action>
<vpd:Finding>Regular heart rythm, 90/min, 1st and 2nd tone normal, no
murmurs.</vpd:Finding>
<vpd:Description>n/a</vpd:Description>
<vpd:Media>

<vpd:MediaPath>/manifest/resources/resource[@identifier='MM_d4084e05a38c38
2c742eaae01353b40a']</vpd:MediaPath>

<vpd:Location>media/CASE_IMAGES/tpl_male_25to40y/Physical_Examination/MEDI
A/inspection/chestSinisterFrontalis.jpg</vpd:Location>
</vpd:Media>
</vpd:PhysicalExam>
<vpd:PhysicalExam id="1231154768844">
<vpd:ExamName>Auscultation of the back</vpd:ExamName>
<vpd:LocationOnBody>
<vpd:BodyPart>back</vpd:BodyPart>
<vpd:FrontOrBack>Back</vpd:FrontOrBack>
</vpd:LocationOnBody>
<vpd:Action>auscultation</vpd:Action>
<vpd:Finding>Respiratory rate 22, normal respiratory sounds over the
right lung, crackles in the left base.</vpd:Finding>
<vpd:Description>n/a</vpd:Description>
<vpd:Media>

<vpd:MediaPath>/manifest/resources/resource[@identifier='MM_8f72bc64ad5322
eeldb12fed1d4d3f9e']</vpd:MediaPath>

<vpd:Location>media/CASE_IMAGES/tpl_male_25to40y/Physical_Examination/MEDI
A/inspection/backDorsalis.jpg</vpd:Location>
</vpd:Media>
</vpd:PhysicalExam>
<vpd:DiagnosticTest id="1231154773394">
<vpd:TestName>Thorax, detail</vpd:TestName>
<vpd:Unit>n/a</vpd:Unit>
```

```

    <vpd:Result>Pathological, infiltrates in left lower lobe, small
leftsided pleural effusion, no pericardiac effusion.&#13;
</vpd:Result>
    <vpd:Normal>n/a</vpd:Normal>
    <vpd:Media>

    <vpd:MediaPath>/manifest/resources/resource[@identifier='MM_92ed22712b29a2
2025aada05a54462d5']</vpd:MediaPath>

    <vpd:Location>media/UPLOADED_MEDIA/labtests/ltCat7.3/Thorax_detail10627507
52973.jpg</vpd:Location>
    </vpd:Media>
</vpd:DiagnosticTest>
<vpd:DiagnosticTest id="1231154776309">
    <vpd:TestName>WBC (Total white blood cell count)</vpd:TestName>
    <vpd:Unit>cells/mm3</vpd:Unit>
    <vpd:Result>16100</vpd:Result>
    <vpd:Normal>5000 - 10,000</vpd:Normal>
</vpd:DiagnosticTest>
<vpd:DiagnosticTest id="1231154776358">
    <vpd:TestName>RBC Count</vpd:TestName>
    <vpd:Unit>million/mm3</vpd:Unit>
    <vpd:Result>5.2</vpd:Result>
    <vpd:Normal>4.2 - 5.7</vpd:Normal>
</vpd:DiagnosticTest>
<vpd:Diagnosis authorDiagnosis="true">
    <vpd:DiagnosisName> This patient reveals symptoms of pneumonia with
high fever, rigors, &#13;chest pain, and cough with purulent sputum. These
symptoms &#13;characteristic for pneumonia, but are not specific for any
single &#13;. Physical exam also reveals the characteristic signs of
&#13;with focal consolidation-dullness to percussion, crackles, &#13;in the
area of consolidation. This is confirmed by chest X-&#13;revealing a left
lower lobe lobar consolidation. Segmental or lobar &#13;are common in
pneumococcal pneumonia.</vpd:DiagnosisName>
</vpd:Diagnosis>
</VirtualPatientData>

```

## dataavailabilitymodel.xml

```

<?xml version="1.0" encoding="UTF-8"?>
<DataAvailabilityModel xmlns="http://ns.medbiq.org/dataavailabilitymodel/v1/"
xmlns:dam="http://ns.medbiq.org/dataavailabilitymodel/v1/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/dataavailabilitymodel/v1/
dataavailabilitymodel.xsd">
<dam:DAMNode id="strKey_MedicalHistoryTopCategoryList">
<dam:DAMNodeLabel>MedicalHistoryTopCategoryList</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154751338']</dam:DAM
NodePath>
<dam:ItemOrder>5</dam:ItemOrder>
</dam:DAMNodeItem>
<dam:DAMNodeItem>

```

```
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154751422']</dam:DAM
NodePath>
<dam:ItemOrder>4</dam:ItemOrder>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="strKey_LabTestTopCategoryList">
<dam:DAMNodeLabel>LabTestTopCategoryList</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154773264']</dam:DAM
NodePath>
<dam:ItemOrder>7</dam:ItemOrder>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154776226']</dam:DAM
NodePath>
<dam:ItemOrder>2</dam:ItemOrder>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154751338">
<dam:DAMNodeLabel>medications</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/InterviewItem[@id='1231154751391']</dam:It
emPath>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154751422">
<dam:DAMNodeLabel>review</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154751691']</dam:DAM
NodePath>
<dam:ItemOrder>0</dam:ItemOrder>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154751691']</dam:DAM
NodePath>
<dam:ItemOrder>0</dam:ItemOrder>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154753055']</dam:DAM
NodePath>
<dam:ItemOrder>0</dam:ItemOrder>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
```

```
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154753823']</dam:DAM
NodePath>
<dam:ItemOrder>0</dam:ItemOrder>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154751691">
<dam:DAMNodeLabel>Cardiac</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/InterviewItem[@id='1231154751888']</dam:ItemPath>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/InterviewItem[@id='1231154751789']</dam:ItemPath>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154753055">
<dam:DAMNodeLabel>Respiratory</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/InterviewItem[@id='1231154753220']</dam:ItemPath>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154753823">
<dam:DAMNodeLabel>General</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/InterviewItem[@id='1231154753906']</dam:ItemPath>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="strKey_PhysicalExamsTopCategoryList">
<dam:DAMNodeLabel>PhysicalExaminationTopCategoryList</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154767751']</dam:DAM
NodePath>
<dam:ItemOrder>2</dam:ItemOrder>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154758953']</dam:DAM
NodePath>
<dam:ItemOrder>4</dam:ItemOrder>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154758953">
<dam:DAMNodeLabel>percussion</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/PhysicalExam[@id='1231154760389']</dam:ItemPath>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154767751">
<dam:DAMNodeLabel>auscultation</dam:DAMNodeLabel>
<dam:DAMNodeItem>
```

```

<dam:ItemPath>/VirtualPatientData/PhysicalExam[@id='1231154768644']</dam:Item
Path>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/PhysicalExam[@id='1231154768844']</dam:Item
Path>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154773264">
<dam:DAMNodeLabel>Radiology</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154773295']</dam:DAM
NodePath>
<dam:ItemOrder>0</dam:ItemOrder>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154773295">
<dam:DAMNodeLabel>CT</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/DiagnosticTest[@id='1231154773394']</dam:It
emPath>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154776226">
<dam:DAMNodeLabel>Hematology</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/manifest/resources/resource[@identifier='MM_TopLevelCategory']
</dam:ItemPath>
<dam:DAMNodePath>/DataAvailabilityModel/DAMNode[@id='1231154776242']</dam:DAM
NodePath>
<dam:ItemOrder>0</dam:ItemOrder>
</dam:DAMNodeItem>
</dam:DAMNode>
<dam:DAMNode id="1231154776242">
<dam:DAMNodeLabel>Hematology - cell counts</dam:DAMNodeLabel>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/DiagnosticTest[@id='1231154776309']</dam:It
emPath>
</dam:DAMNodeItem>
<dam:DAMNodeItem>
<dam:ItemPath>/VirtualPatientData/DiagnosticTest[@id='1231154776358']</dam:It
emPath>
</dam:DAMNodeItem>
</dam:DAMNode>
</DataAvailabilityModel>

```

## activitymodel.xsd

```

<?xml version="1.0"?>
<ActivityModel xmlns="http://ns.medbiq.org/activitymodel/v1/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/activitymodel/v1/
http://ns.medbiq.org/activitymodel/v1/activitymodel.xsd">
  <ActivityNodes>

```

```

    <NodeSection id="A" label="Medical History">
      <ActivityNode id="2" label="Medical History">

        <Content>/DataAvailabilityModel/DAMNode[@id='strKey_MedicalHistoryTopCategoryList']</Content>
      </ActivityNode>
    </NodeSection>
    <NodeSection id="B" label="Physical Exams">
      <ActivityNode id="3" label="Physical Exams">

        <Content>/DataAvailabilityModel/DAMNode[@id='strKey_PhysicalExamsTopCategoryList']</Content>
      </ActivityNode>
    </NodeSection>
    <NodeSection id="C" label="Lab Tests">
      <ActivityNode id="4" label="Lab Tests">

        <Content>/DataAvailabilityModel/DAMNode[@id='strKey_LabTestTopCategoryList']</Content>
      </ActivityNode>
    </NodeSection>
  </ActivityNodes>

  <Links>
    <Link>

      <ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='2']</ActivityNodeA>

      <ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='3']</ActivityNodeB>
      </Link>
      <Link>

      <ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='2']</ActivityNodeA>

      <ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='4']</ActivityNodeB>
      </Link>
      <Link>

      <ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='3']</ActivityNodeA>

      <ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='2']</ActivityNodeB>
      </Link>
      <Link>

      <ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='3']</ActivityNodeA>

      <ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='4']</ActivityNodeB>
      </Link>
      <Link>

```

```
<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='
4']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='
2']</ActivityNodeB>
  </Link>
  <Link>

<ActivityNodeA>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='
4']</ActivityNodeA>

<ActivityNodeB>/ActivityModel/ActivityNodes/NodeSection/ActivityNode[@id='
3']</ActivityNodeB>
  </Link>
</Links>
</ActivityModel>
```

## 12 References

### MedBiquitous Documents:

- MedBiquitous Virtual Patient Player Specification and Description Document, [http://www.medbiq.org/working\\_groups/virtual\\_patient/VirtualPatientPlayerSpecification.pdf](http://www.medbiq.org/working_groups/virtual_patient/VirtualPatientPlayerSpecification.pdf)
- Healthcare Learning Object Metadata Specifications and Description Document [http://www.medbiq.org/working\\_groups/learning\\_objects/HealthcareLOMSpecification.pdf](http://www.medbiq.org/working_groups/learning_objects/HealthcareLOMSpecification.pdf)
- SCORM for Healthcare, [http://www.medbiq.org/working\\_groups/learning\\_objects/SCORMforHealthcareSpecification.pdf](http://www.medbiq.org/working_groups/learning_objects/SCORMforHealthcareSpecification.pdf)

### Advanced Distributed Learning (ADL) Documents (see <http://www.adlnet.gov>):

- SCORM® 2004 4th Edition Content Aggregation Model (CAM) Version 1.0
- SCORM® 2004 4th Edition Run-Time Environment (RTE) Version 1.0
- Sharable Content Object Reference Model (SCORM)® 2004 4th Edition Overview Version 1.0

### Others documents:

- XML Path Language (XPath) 2.0, W3C Recommendation <http://www.w3.org/TR/xpath>
- XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition) <http://www.w3.org/TR/xhtml1/>

### XML Schema Part 2: Datatypes Second Edition document

<http://www.w3.org/TR/xmlschema-2/>