



**Virtual Medical Record (vMR) for Clinical Decision  
Support – HL7 V2 Profile  
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# 1 Executive Summary

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2 A Virtual Medical Record (vMR) for Clinical Decision Support (CDS) is a data model  
3 for representing clinical information *inputs* and *outputs* that can be exchanged  
4 between CDS engines and local clinical information systems, through mechanisms  
5 such as CDS services. A vMR for CDS is needed to enable the design and  
6 development of scalable CDS resources that can be used across multiple healthcare  
7 institutions and health information systems.

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9 The objective of the HL7 CDS Work Group's vMR HL7 V2 profile is to allow clinical  
10 information inputs as a HL7 V2 message. The data content of the message is based  
11 on the HL7 V3 CCD document and all OIDS and LOINC codes are taken from that  
12 document. The options with respect to data values also rely on the CCD document.  
13 The profile does not extend the HL7 V2 standard but describes a way of  
14 representing the structure of the data relevant to a VMR in a HL7 V2 message. The  
15 main mechanism used is the use of OBX-4 Observation Sub ID to contain a  
16 shortened OID.

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18 This is the first informative ballot for this material and currently it relies heavily on  
19 the existing HL7 V3 CCD document. Input is sought on the mechanism and direction  
20 as to whether the existing CCD documentation should be moved into this document  
21 to make it stand alone. It is envisaged that all elements of the final VMR, when this is  
22 finalised will be included in this guide.

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## 25 **2 Representing VMR data in HL7 V2 Messages**

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This document should be read in conjunction with the HL7 CCD guide.

HL7 CCD	HL7 Implementation Guide: CDA Release 2 – Continuity of Care Document (CCD)	<a href="http://www.hl7.org">http://www.hl7.org</a>
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### Background

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The CCD Document (CDA format) provides an important source of data for the VMR but in some places HL7 V2 is still in active use and this document presents a mechanism of encoding the same data in a HL7 V2 message to allow the use of HL7 V2 messages for clinical decision support. The examples will be extended to cover the full range of data items in the final Virtual Medical Record when it is fully specified.

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To include all the required data several HL7 V2 messages may be required. In V2.x a ORU message containing the data as detailed below, combined with a Medication Order to detail the Medication and Allergy history would be required. In Australia these have been combined into a single message with the REF/RRI message structure extended to carry repeating ORC/RXO/RXR/RXC groups to enable a medication summary to be included in the one message. See the link below. In the case where several messages are required a File/Batch headers may be used to group the ORU and Medication Order message into a single message for transmission to a decision support service.

Result data can be added as ORC/OBR/OBX groups and this data is identical to that in the native lab messages in eg ORU format.

AS4700.6 – 2006	Australian Standard, HL7 v2.4/v2.3.1 – Referral, Discharge and health record messaging	<a href="http://www.e-healthstandards.org.au/">http://www.e-healthstandards.org.au/</a>
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The chosen representation uses OBX segments to represent all the CCD sections and the data mirrors the CCD data closely and uses the CCD Template Ids in the OBX-4 Observation Sub-ID to identify which CCD data item it is representing. When repeating data items are required with the same OBX-3 Observation Identifier and OBX-4 observation Sub-ID the CCD OID is extended deeper to ensure uniqueness.

This mechanism of structuring data within the OBX segments allows the necessary structure to represent the VMR data reliably and in a loss less manner. The data contained the semantic richness needed to build a VMR from the V2 message, in a similar way that a CCD document can be used to build a VMR. The general pattern in a Section header identified by the LOINC code “28562-7” and the appropriate CCD OID followed by the relevant data for that section using the codes and OIDs specified in the CCD document. The combination of the OBX-3 code and OBX-4 SubID must be unique and the CCD OIDS are extended as required to support repeating data items. This allows for eg. multiple Family History entries using the same LOINC codes and OID. The structure of the data in the message is dependent on the CCD document semantics.

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**Representing Atomic Data In Sections**

The Sections and data items correspond and are based on the HL7 Implementation Guide: CDA Release 2 – Continuity of Care Document (CCD) and this can be used as a guide to appropriate value sets and data items to populate the sections with atomic data. As this is a V2 implementation guide there are some differences, notably Medication is represented in the HL7 V2 specific segments as is Allergies. All other sections are represented using groups of OBX segments identified and grouped by the use of the OBX-4 “Observation SubID”. The CCD Template ID is used to populate the OBX-4 Observation SubID and where the data repeats the CCD OID is extended with instance numbers. Eg: For repeating Family History relatives the first has “.1.” appended and the second “.2”. The resulting OID is a child of the CCD one and can be matched on this basis. The OIDs used are truncated by removing to Root CCD OID parts and using the shortened OID. The full OID could be used but could break the length restrictions in some implementations.

Eg: The Full CCD OID for the relative in Family History is “2.16.840.1.113883.10.20.1.23” but as many relatives can be represented the first item has the OID of “2.16.840.1.113883.10.20.1.23.1”. Because the root OID for the CCD document is “2.16.840.1.113883.10.20.1” this OID can be shorted to “**23.1**”. The OBX-4 SubID’s are highlighted in red in the example HL7.

**CCD sections and data Items and mapping to the OBX-4 SubID**

Section SubID	Data SubIDs	Comment	Text
<b>1</b>			<b>Advance directives section</b>
	17		<i>Advance directive observation</i>
	36		<i>Advance directive reference</i>
	37		<i>Advance directive status observation</i>
<b>2</b>		<b>Allergies use AL1</b>	<b>Alerts section</b>
	18		<i>Alert observation</i>
<b>3</b>			<b>Encounters section</b>
	21		<i>Encounter activity</i>
<b>4</b>			<b>Family history section</b>
	22		<i>Family history observation</i>
	23		<i>Family history organizer</i>
	38		<i>Age observation</i>
<b>5</b>			<b>Functional status section</b>
<b>6</b>			<b>Immunizations section</b>
<b>7</b>			<b>Medical equipment section</b>
<b>8</b>		<b>HL7 V2 Segments used</b>	<b>Medications section</b>
<b>9</b>			<b>Payers section</b>
	26		<i>Policy activity</i>
	19		<i>Authorization activity</i>
	20		<i>Coverage activity</i>
<b>10</b>			<b>Plan of care section</b>
	25		<i>Plan of care activity</i>
<b>11</b>			<b>Problem section</b>
	27		<i>Problem act</i>
	28		<i>Problem observation</i>
<b>12</b>			<b>Procedures section</b>
	29		<i>Procedure activity</i>

<b>13</b>			<b>Purpose section</b>
	30		<i>Purpose activity</i>
<b>14</b>		<b>ORC/OBR/OBX used</b>	<b>Results section</b>
<b>15</b>			<b>Social history section</b>
	33		<i>Social history observation</i>
<b>16</b>			<b>Vital signs section</b>
	35		<i>Vital signs organizer</i>

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The following examples use very similar data to the Level 3 CDA CCD example document.

The document header is represented in the OBR segment and contains the root CCD OID allowing identification of the fact that this is a HL7 V2 representation of a CCD document. The root CCD OID is highlighted in red. Pre-pending this to the Value used in the OBX-4 SubID results in the full OID for the data item.

```
OBR|1||db734647-fc99-424c-a864-7e3cda82e703^Good Health
Clinic^2.16.840.1.113883.19.5^ISO|34133-9^Referral
Summary^LN^2.16.840.1.113883.10.20.1^ISO|||200004071300+1100|||
||201003211505+1100||PHY|F|^20100321+1100|||000000Y&Dolin&Robert&&&D
r.
```

Examples of the HL7 V2 representation of Data in sections:

Sections
<p><b>Purpose of Referral</b></p> <pre>OBX 1 CE 28562-7^LN 13 48764-5^Purpose of referral^LN    F OBX 2 FT 15431-0^LN 30 Transfer of care    F</pre>
<p><b>Payers</b></p> <pre>OBX 3 CE 28562-7^LN 11 48768-6^Payers^LN    F OBX 4 CE EHC POL^Extended healthcare^ACT CODE 26 329fcd f0-7ab3-11db-9fe1-0800200c9a66^Good Health Insurance^L    F OBX 5 CE 29300-1^Procedure^LN 19 73761001^Colonoscopy^SNOMED-CT    F</pre>
<p><b>Advance Directives</b></p> <pre>OBX 6 CE 28562-7^LN 1 42348-3^Advance Directives^LN    F OBX 7 CE 304251008^Resuscitation^SNOMED-CT 17 304253006^Do not resuscitate^SNOMED- CT    F  19991107 OBX 8 RP 371538006^Advance Directive^SNOMED-CT 36 AdvanceDirective.b50b7910-7ffb-4f4c-bbe4- 177ed68cbbf3.pdf^application/pdf^AP^Octet-stream    F</pre>
<p><b>Functional Status</b></p>

OBX|9|CE|28562-7^^LN|5|47420-5^Functional Status^LN|||||F  
 OBX|10|CE|54522-8^^LN^ASSERTION^^L|28.1|105504002^Dependence on cane^SNOMED-CT|||||F|||1998  
 OBX|11|CE|54522-8^^LN^ASSERTION^^L|28.2|386807006^Memory Impairment^SNOMED-CT|||||F|||1998

**Problems**

OBX|12|CE|28562-7^^LN|11|11450-4^Problem List^LN|||||F  
 OBX|13|CE|44100-6^^LN^ASSERTION^^L|28.1|195967001^Asthma^SNOMED-CT|||||F|||1950  
 OBX|14|CE|33999-4^Status^LN|50.1|55561003^Active^SNOMED-CT|||||F  
 OBX|15|CE|44100-6^^LN^ASSERTION^^L|28.2|233604007^Pneumonia^SNOMED-CT|||||F|||199701  
 OBX|16|CE|33999-4^Status^LN|50.2|413322009^Resolved^SNOMED-CT|||||F  
 OBX|17|CE|44100-6^^LN^ASSERTION^^L|28.3|22298006^Myocardial Infarction^SNOMED-CT|||||F|||199701  
 OBX|18|CE|33999-4^Status^LN|50.3|413322009^Resolved^SNOMED-CT|||||F

**Note:** SubID's ending in ".1" all relate to the first problem, and ".2" to the second problem etc. The nesting can be extended deeper as required and this is done in the Family History section below. The first digit of the SubID relates to the CCD OID and the remaining dotted numbers create the tree structure of the data.

**Family History**

OBX|19|CE|28562-7^^LN|4|10157-6^Family History^LN|||||F  
 OBX|20|CE|54136-7^^LN|23.1|9947008^Biological Father^SNOMED-CT|||||F  
 OBX|21|CE|54114-4^^LN|22.1.1|22298006^MI^SNOMED-CT|||||F  
 OBX|22|CE|54112-8^Cause of Death^LN|42.1.1|31874001^True^SNOMED-CT|||||F  
 OBX|23|NM|54113-6^Age at Death^LN|38.1.1|57|||||F  
 OBX|24|CE|54114-4^^LN|22.1.2|59621000^Hypertension^SNOMED-CT|||||F  
 OBX|25|NM|54115-1^Age at Onset^LN|38.1.2|40|||||F  
 OBX|26|CE|54136-7^^LN|23.2|65656005^Biological Mother^SNOMED-CT|||||F  
 OBX|27|CE|54114-4^^LN|22.2.1|195967001^Asthma^SNOMED-CT|||||F|||1942

**Social History**

OBX|28|CE|28562-7^^LN|15|29762-2^Social History^LN|||||F  
 OBX|29|NM|230056004^Cigarette Smoking^SNOMED-CT|33.1.1|1|packets/day^^L|||||F|||1947  
 OBX|30|NM|230056004^Cigarette Smoking^SNOMED-CT|33.1.2|0|packets/day^^L|||||F|||1972  
 OBX|31|ST|11330-8^Alcohol Use^LN|33.2|None|||||F|||1972

**Alerts**

Use AL1 for Allergies. Other Alerts can be represented in a section using OBX Segments.

AL1|1|DA|70618^Penicillin^CPT-4||Hives|1980

### Medications

Use standard HL7 V2 Medication segments for medication

ORC|RE||cddb5b01-6cde-11db-9fe1-0800200c9a66^Good Health Clinic^2.16.840.1.113883.19.5^ISO||||^^1972^^^Q12H||||000000Y^Dolin^Robert^^^Dr.^^^^^^L

RXO|430618^Metoprolol 25mg^CPT-4|25|mg^ISO+|||||||||||||22298006^Myocardial Infarction^SNOMED-CT

RXR|PO^^HL70162

### Medical Equipment

OBX|32|CE|28562-7^LN|7|46264-8^Medical Equipment^LN|||||F

OBX|33|CE|42556-1^LN|34.1|72506001^Automatic implantable cardioverter/defibrillator^SNOMED-CT|||||F|||199911

OBX|34|CE|42556-1^LN|34.2|304120007^Total hip replacement prosthesis^SNOMED-CT|||||F|||1998|0abea950-5b40-4b7e-b8d9-2a5ea3ac5500^Good Health Prostheses Company^L

### Immunizations

OBX|36|CE|28562-7^LN|6|11369-6^Immunizations^LN|||||F

OBX|37|CE|39235-7^LN|53.1|88^Influenza virus vaccine^CDC|||||F|||199911

OBX|38|CE|39235-7^LN|53.2|33^Pneumococcal polysaccharide vaccine^CDC|||||F|||199812

### Vital Signs

OBX|39|CE|28562-7^LN|16|^Vital Signs^LN|||||F

OBX|40|NM|50373000^Body Height^SNOMED-CT|31.1.1|177|cm^ISO+|||||F|||19991114

OBX|41|NM|27113001^Body Weight^SNOMED-CT|31.1.2|86|kg^ISO+|||||F|||19991114

OBX|42|NM|271649006^Systolic BP^SNOMED-CT|31.1.3|132|mm[Hg]^ISO+|||||F|||19991114

OBX|43|NM|271650006^Diastolic BP^SNOMED-CT|31.1.4|86|mm[Hg]^ISO+|||||F|||19991114

### Results

ORC/OBR/OBX of existing document

### Procedures

OBX|44|CE|28562-7^LN|12|47519-4^Procedures^LN|||||F

OBX|45|CE|29300-1^^LN|29.1|52734007:272741003=7771000^Total Hip Replacement (left)^SNOMED-CT|||||F|||1998

**Encounters**

OBX|46|CE|28562-7^^LN|3|46240-8^Encounters^LN|||||F

OBX|47|FT|11346-4^^LN|21|Checkup Examination (Good Health Clinic)||||||F|||20000407

**Plan of Care**

OBX|48|CE|28562-7^^LN|11|18776-5^Plan of care^LN|||||F

OBX|49|CE|21979-0^Planned Activity^LN|25.1|23426006^Pulmonary Function Tests^SNOMED-CT|||||F|||20000421

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**Used Clinical LOINC CODES**

28562-7	CHART SECTION (CMLPX)
15431-0	SERVICE COMMENT
29300-1	PROCEDURE
54522-8	FUNCTIONAL STATUS
44100-6	MEDICAL PROBLEM
33999-4	STATUS {DIAGNOSIS}
54136-7	RELATIONSHIP TO PATIENT {FAMILY MEMBER}
54112-8	CAUSE OF DEATH {FAMILY MEMBER}
54113-6	AGE RANGE AT DEATH {FAMILY MEMBER}
54115-1	AGE RANGE AT ONSET OF DISEASE {FAMILY MEMBER}
11330-8	ALCOHOL USE
42556-1	EVENT DESC.EQUIPMENT & OR DEVICE
39235-7	IMMUNIZATION DATA
29300-1	PROCEDURE
11346-4	HISTORY OF OUTPATIENT VISITS
21979-0	PLANNED OR NEXT FOLLOW UP
48764-5	SUMMARY PURPOSE {CCD}

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**Notes on HL7 V2 display:**

121 In general no display text is used in OBX-3 Observation Identifier (A CE data type) because  
122 the Section headers group the data into logical groups and provide enough context to make  
123 display of this redundant. The LOINC codes do however define what the nature of the value  
124 is and display of text in OBX-3 would not change the meaning. Applications using this data  
125 to build a Virtual Medical Record can use the OBX-4 SubID and OBX-3 Observation

- 126** Identifier to identify the correct place to place the data in an OBX into the VMR model.
- 127** Nesting and repeating groups are structured using the "Dotted" OBX-4 SubID to indication
- 128** structure.
- 129**
- 130**
- 131**