CDAR2\_IG\_HAIRPT\_R3\_D3\_2018OCT\_

Vol1\_Introductory\_Material



**HL7 CDA® R2 Implementation Guide:**

**NHSN Healthcare Associated Infection (HAI) Reports**

**Release 3, STU 3—US Realm**

**Volume 1—Introductory Material**

October 2018

**Release 3, 3rd HL7 Standard for Trial Use (STU)**

**Sponsored by:   
Structured Documents Work Group**

**National Healthcare Safety Network (NHSN)**

Copyright © 2018 Health Level Seven International ® ALL RIGHTS RESERVED. The reproduction of this material in any form is strictly forbidden without the written permission of the publisher. HL7 and Health Level Seven are registered trademarks of Health Level Seven International. Reg. U.S. Pat & TM Off**.**

Use of this material is governed by HL7's [**IP Compliance Policy**](http://www.hl7.org/legal/ippolicy.cfm?ref=nav).

**IMPORTANT NOTES:**

HL7 licenses its standards and select IP free of charge. **If you did not acquire a free license from HL7 for this document,** you are not authorized to access or make any use of it. To obtain a free license, please visit http://www.HL7.org/implement/standards/index.cfm.

**If you are the individual that obtained the license for this HL7 Standard, specification or other freely licensed work (in each and every instance "Specified Material")**, the following describes the permitted uses of the Material.

**A. HL7 INDIVIDUAL, STUDENT AND HEALTH PROFESSIONAL MEMBERS,** who register and agree to the terms of HL7’s license, are authorized, without additional charge, to read, and to use Specified Material to develop and sell products and services that implement, but do not directly incorporate, the Specified Material in whole or in part without paying license fees to HL7.

INDIVIDUAL, STUDENT AND HEALTH PROFESSIONAL MEMBERS wishing to incorporate additional items of Special Material in whole or part, into products and services, or to enjoy additional authorizations granted to HL7 ORGANIZATIONAL MEMBERS as noted below, must become ORGANIZATIONAL MEMBERS of HL7.

**B. HL7 ORGANIZATION MEMBERS,** who register and agree to the terms of HL7's License, are authorized, without additional charge, on a perpetual (except as provided for in the full license terms governing the Material), non-exclusive and worldwide basis, the right to (a) download, copy (for internal purposes only) and share this Material with your employees and consultants for study purposes, and (b) utilize the Material for the purpose of developing, making, having made, using, marketing, importing, offering to sell or license, and selling or licensing, and to otherwise distribute, Compliant Products, in all cases subject to the conditions set forth in this Agreement and any relevant patent and other intellectual property rights of third parties (which may include members of HL7). No other license, sublicense, or other rights of any kind are granted under this Agreement.

**C. NON-MEMBERS,** who register and agree to the terms of HL7’s IP policy for Specified Material, are authorized, without additional charge, to read and use the Specified Material for evaluating whether to implement, or in implementing, the Specified Material, and to use Specified Material to develop and sell products and services that implement, but do not directly incorporate, the Specified Material in whole or in part.

NON-MEMBERS wishing to incorporate additional items of Specified Material in whole or part, into products and services, or to enjoy the additional authorizations granted to HL7 ORGANIZATIONAL MEMBERS, as noted above, must become ORGANIZATIONAL MEMBERS of HL7.

Please see http://www.HL7.org/legal/ippolicy.cfm for the full license terms governing the Material.

**Ownership. Licensee agrees and acknowledges that HL7 owns all right, title, and interest, in and to the Materials. Licensee shall take no action contrary to, or inconsistent with, the foregoing.**

**Licensee agrees and acknowledges that HL7 may not own all right, title, and interest, in and to the Materials and that the Materials may contain and/or reference intellectual property owned by third parties (“Third Party IP”). Acceptance of these License Terms does not grant Licensee any rights with respect to Third Party IP. Licensee alone is responsible for identifying and obtaining any necessary licenses or authorizations to utilize Third Party IP in connection with the Materials or otherwise. Any actions, claims or suits brought by a third party resulting from a breach of any Third Party IP right by the Licensee remains the Licensee’s liability.**

Following is a non-exhaustive list of third-party terminologies that may require a separate license:

| **Terminology** | **Owner/Contact** |
| --- | --- |
| Current Procedures Terminology (CPT) code set | American Medical Association http://www.ama-assn.org/ama/pub/physician-resources/solutions-managing-your-practice/coding-billing-insurance/cpt/cpt-products-services/licensing.page? |
| SNOMED CT | International Healthcare Terminology Standards Development Organization (IHTSDO) [get-snomed-ct](http://www.ihtsdo.org/snomed-ct/get-snomed-ct) or info@ihtsdo.org |
| Logical Observation Identifiers Names & Codes (LOINC) | Regenstrief Institute |
| International Classification of Diseases (ICD) codes | World Health Organization (WHO) |
| NUCC Health Care Provider Taxonomy code set | American Medical Association. Please see 222.nucc.org. AMA licensing contact: 312-464-5022 (AMA IP services) |

Structure of This Guide

Two volumes comprise the complete *HL7 CDA® R2 Implementation Guide: NHSN Healthcare Associated Infection (HAI) Reports.* Volume 1 provides narrative introductory and background material pertinent to this implementation guide, including information on how to understand and use the templates in Volume 2. Volume 2 contains the normative Clinical Document Architecture (CDA) templates for this guide along with lists of all templates, code systems, value sets, and, when appropriate, changes from the previous version.

The HAI implementation guide also includes a third volume and a fourth volume that are stand-alone subsets for implementers. The third volume contains Single-Person (Numerator) and Summary (Denominator) Reports dealing with Antimicrobial Resistance (AR) and Antimicrobial Use (AU) data. The fourth volume contains the Summary (Denominator) Report dealing with Hemovigilance (HV) data. Both Volumes 3 and 4 contain most of the introductory material from Volume 1 as well as exact copies of the relevant (AU, AR, and HV) templates contained in Volume 2.

Additional information in Volume 1 for the HAI implementation guide includes a summary of changes from all previous versions, document and section codes used in HAI reports, a list of Consolidated CDA (C-CDA) templates referenced by HAI templates, information and examples of non-normative identifiers, and an explanation of vocabulary heuristics for code systems and value sets used by HAI templates.

|  |  |  |  |
| --- | --- | --- | --- |
| Co-Chair: | Calvin Beebe Mayo Clinic [cbeebe@mayo.edu](mailto:cbeebe@mayo.edu) | Co-Chair: | Austin Kreisler Leidos Consultant to CDC/NHSN [duz1@cdc.gov](mailto:duz1@cdc.gov) |
| Co-Chair: | Brett Marquard River Rock Associates [brett@riverrockassociates.com](mailto:brett@riverrockassociates.com) | Co-Chair: | Gaye Dolin M.S.N., R.N. Intelligent Medical Objects [gdolin@imo-online.com](mailto:gdolin@imo-online.com) |
| Co-Chair: | Rick Geimer Lantana Consulting Group [rick.geimer@lantanagroup.com](mailto:rick.geimer@lantanagroup.com) | Co-Chair: | John Roberts Tennessee Department of Health [john.a.roberts@tn.gov](mailto:john.a.roberts@tn.gov) |
| Co-Chair: | Rob Savage MS  Rob Savage Consulting [rob.savage50@gmail.com](mailto:rob.savage50@gmail.com) | Co-Chair: | Joginder Madra  Madra Consulting Inc. [hl7@madraconsulting.com](mailto:hl7@madraconsulting.com) |
| Co-Chair: | Erin Holt MPH  Tennessee Department of Health [erin.holt@tn.gov](mailto:erin.holt@tn.gov) | Co-Chair: | Ben Flessner  Redox [benjamin@redoxengine.com](mailto:benjamin@redoxengine.com) |
| Primary Editor: | Sarah Gaunt Lantana Consulting Group [sarah.gaunt@lantanagroup.com](mailto:sarah.gaunt@lantanagroup.com) | Co-Editor: | Mindy Durrance  Leidos Consultant to CDC/NHSN [mdq1@cdc.gov](mailto:mdq1@cdc.gov) |
| Co-Editor: | Daniel Pollock, M.D. CDC [DPollock@cdc.gov](mailto:DPollock@cdc.gov) | Co-Editor: | Ahmed Tahir  Leidos Consultant to CDC/NHSN [nmn8@cdc.gov](mailto:nmn8@cdc.gov) |
| Co-Editor: | Barry Rhodes CDC  [mbr1@cdc.gov](mailto:mbr1@cdc.gov) | Co-Editor: | Sheila Abner  CDC  [sha8@cdc.gov](mailto:sha8@cdc.gov) |
| Co-Editor: | Amy Webb Lantana Consulting Group  [amy.webb@lantanagroup.com](mailto:amy.webb@lantanagroup.com) | Co-Editor: | James Davis  Leidos Consultant to CDC/NHSN  [mync0@cdc.gov](mailto:mync0@cdc.gov) |
| Co-Editor: | George Koromia Lantana Consulting Group [george.koromia@lantanagroup.com](mailto:george.koromia@lantanagroup.com) | Co-Editor: | Beau Bannerman  Lantana Consulting Group [beau.bannerman@lantanagroup.com](mailto:beau.bannerman@lantanagroup.com) |
| Co-Editor: | Lauren Wood Lantana Consulting Group [lauren.wood@lantanagroup.com](mailto:lauren.wood@lantanagroup.com) | Co-Editor: | Eric Parapini Lantana Consulting Group [eric.parapini@lantanagroup.com](mailto:eric.parapini@lantanagroup.com) |
| Co-Editor: | Zabrina Gonzaga Lantana Consulting Group [zabrina.gonzaga@lantanagroup.com](mailto:zabrina.gonzaga@lantanagroup.com) | Co-Editor | Sean McIlvenna  Lantana Consulting Group  [sean.mcilvenna@lantanagroup.com](mailto:sean.mcilvenna@lantanagroup.com) |
| Technical Editor: | Chris Hannigan  Lantana Consulting Group [chris.hannigan@lantanagroup.com](mailto:chris.hannigan@lantanagroup.com) | Technical Editor: | Diana Wright Lantana Consulting Group [diana.wright@lantanagroup.com](mailto:diana.wright@lantanagroup.com) |

Acknowledgments

This implementation guide was produced and developed by Lantana Consulting Group in conjunction with the Division of Healthcare Quality Promotion in the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) at the Centers for Disease Control and Prevention (CDC). Its development and ultimate deployment is a result of the dedication of the team—led by Daniel A. Pollock, M.D., Surveillance Branch Chief, Division of Healthcare Quality Promotion, NCEZID, CDC—and their support of the development of interoperable data standards for the CDC’s National Healthcare Safety Network (NHSN).

The best standards are those driven by business requirements. A strong set of Healthcare Associated Infection (HAI) surveillance application vendors monitor, evaluate, and test each release of this guide.

Past contributors: The vendors who participated in the 2007-2008 pilot activities of Bloodstream Infection Reports and Surgical Site Infection deserve special thanks and acknowledgment: MedMined™ services from Cardinal Health, EpiQuest, ICPA, Premier, TheraDoc, and Vecna Technologies. Throughout the development of this guide, Marla Albitz provided essential translation of NHSN business and technical requirements so that Kate Hamilton, Bob Dolin, Rick Geimer, and Susan Hardy could turn those requirements into a CDA-compliant specification. Liora Alschuler provided oversight and review. Additional contributors to the DSTU releases have been Jonathan Edwards, Maggie Dudeck, Dawn Sievert, Teresa Horan, Mary Andrus, Melinda Neuhauser, Ruby Phelps, Mindy Durrance, Alicia Shugart, Tygh Walker, Chris Cole, Cindy Gross, and Scott Fridkin (data specifications); Wenkai Li, Pavla Frazier, Gaye Dolin, Margaret Marshburn, Rob Hausam, Sundak Ganesan, and Denny Cordy (vocabulary); Kelly Peterson (database administration); Venu Sarraff (data importation); and Brett Marquard and Lauren Wood (project management and technical editing). We also thank Ted Klein, Cecil Lynch, and Daniel Vreeman for timely issuance of identifiers and codes.

This specification is a set of constraints on existing work, and the extent to which it can accommodate the expressive requirements of HAI reporting over time is a function of the richness of the model on which it is built, the Health Level Seven (HL7) Reference Information Model (RIM) and the RIM document standard, and the Clinical Document Architecture Release 2 (CDA R2). We thank all those who have worked for over a decade to produce these fundamental specifications.

This material contains content from SNOMED CT® ([snomed-ct](http://www.ihtsdo.org/snomed-ct/)). SNOMED CT is a registered trademark of the International Health Terminology Standard Development Organisation (IHTSDO).

This material contains content from LOINC® ([loinc](http://loinc.org/)). The LOINC table, LOINC codes, and LOINC panels and forms file are copyright © 1995-2018, Regenstrief Institute, Inc. and the Logical Observation Identifiers Names and Codes (LOINC) Committee and available at no cost under the license at [loinc terms-of-use](http://loinc.org/terms-of-use).

Revision History

| Release | Date | Notes |
| --- | --- | --- |
| DSTU 1 | February 28, 2008 | First release of the DSTU |
| DSTU 2 | August 6, 2008 | Updated four reports, added one report |
| December 4, 2008 | Updated five reports, added eight reports |
| February 27, 2009 | Integrated January 2009 ballot resolutions |
| DSTU 3 | March 30, 2009 | Added two reports |
| June 25, 2009 | Integrated May 2009 ballot resolutions  Replaced fine-grained NHSN codeSystems with a single NHSN vocabulary  Replaced temporary NHSN code values with final NHSN code values |
| DSTU 4 | August 7, 2009 | Added one report, updated Population Summary Reports to include a new form.  Converted to Templates Database constraints format. |
| October 30, 2009 | Integrated September 2009 ballot resolutions. |
| DSTU 4.1 | January 14, 2010 | Updated UTI Urinary Catheter Observation.  Added History of Object Presence Observation. |
| DSTU 5 | April 7, 2010 | Added Hemovigilance Incident Report (HI).  In the Population Summary Reports, added a code in the header to distinguish types of summary report; added values to support summary reporting for hemovigilance incidents and blood-product usage; converted some value sets to lists of single-value bindings.  Modified data reported in the CLIP, Procedure, and Laboratory-identified organism (LIO) Reports as requested by NHSN. |
| June 28, 2010 | Incorporated May 2010 ballot resolutions. |
| DSTU 6 | August 27, 2010 | Added Hemovigilance Adverse Reaction Report (HAR).  In the Population Summary Reports, added values to support antimicrobial usage and resistance data (AUP).  Adapted several clinical statements to support nullFlavor or text. |
| January 20, 2011 | Incorporated September 2010 ballot resolutions |
| DSTU 7 | August 5, 2011 | Added Dialysis Event Numerator Report.  In Population Summary Reports, added values for dialysis reporting.  Removed the MDRO/CDAD Report and the clinical statements uniquely identified with it  Replaced the MDRO Observation with an MDRO/CDI Observation.  Updated the Findings Section in infection-type reports to require the new MDRO/CDI Observation, and in Generic Infection Report also to require a Significant Pathogens Observation. Updated the LIO Report to require a Significant Pathogens Observation. |
| January 15, 2012 | Updated vocabulary and value sets per CDC/NHSN requirements.  Updated the top-level templateId.  Removed the Generic Infection Report (not used).  Updated the templateId for Findings Section in a LIO Report and Findings Section in infection-type reports, plus the templateIds of those reports.  Updated Dialysis Event Numerator Report, renamed as Evidence of Infection (Dialysis) Report.  Converted some value sets from STATIC to DYNAMIC bindings. |
| DSTU 8 | July 2012 | No new reports in this release. Minor revisions to several templates. Updated the top-level templateId.  Recast the population summary body templates and created a separate section for them, in response to user ease-of-use wishes (no modeling change).  Refactored the distribution of header constraints between header templates, to remove exceptions that have accumulated over time (no modeling change).  Edited constraints to contain only one XML node per constraint (no modeling change). |
| DSTU 9 | September 2012 | This release added no new reports.  Four numerator reports and four denominator reports were removed from this release of the HAI implementation guide (IG). These reports may be reintroduced in future. Reasons for removal include (1) not yet implemented, and/or (2) undergoing substantial change.  Minor revisions to several templates.  Added several new templates.  Updated the top-level templateId. |
| Normative Release 1 | January 2013 | (First ballot)  Restructure of IG to align with "state of the art" HL7 IGs for easier navigation.  HAI templates now based on Consolidated CDA (C-CDA) templates  Summary reports moved into separate templates  Narrative constraints converted to computable constraints.  Added Antimicrobial Resistance Option (ARO) Summary Report and HAI AUR Antimicrobial Resistance Option (ARO) Report |
| March 2013 | (Second ballot)  Remodeled Antimicrobial Resistance Option (ARO) Summary Report |
| June 2013 | Publication of Normative Release 1 |
| Normative Release 2 | September 2013 | (First ballot; DSTU 1)  Added no new reports.  Added templates to SSI, Procedure, and Dialysis  Added codes to ICU Summary, NICU Summary, SCA Summary, and Dialysis Reports |
| January 2014 | (Update to first ballot; DSTU 1.1)  No normative / substantive changes  Split guide into two volumes  Added and/or deprecated values in some value sets |
| February 2014 | Publication of DSTU 1.1 |
| May 2014 | (Second ballot)  Added two new reports |
| June 2014 | Publication of DSTU 2 |
| December 2014 | (Update to second ballot; DSTU 2.1)  Included new system of identifying templates by OID or URN  Updated seven reports |
| May 2015 | First Normative ballot  Created Volume 3, a stand-alone subset containing the Volume 1 introductory material and complete copies of all AU and AR reports.  Updated three reports to update the template id representing the IG in which the template is published and from which the template will be implemented. |
| Normative Release 3 | September 2015 | (First ballot; DSTU 1)  Added new Hemovigilance (HV) report  Added templates to Dialysis  Created Volume 4, a stand-alone subset containing the Volume 1 introductory material and complete copies of all HV report templates.  Added new HTML format IG |
| December 2015 | Publication of DSTU 1 |
| September 2016 | (Update to first ballot; DSTU 1.1)  Added new template to Dialysis  Added new template to HV  Replaced pathogen codes  Updated, added and removed codes |
| October 2016 | Publication of DSTU 1.1 |
| May 2017 | (Second ballot; STU 2)  Added new Ventilator Associated Event (VAE) report  Added new Influenza Vaccination Summary (HP FLU) report  Added new Comment Section (for use in multiple reports)  Updated Bloodstream Infection Report (BSI) with 3 new templates |
| July 2017 | Publication of STU 2 |
| May 2018 | (Third ballot; STU 3)  Added new Late Onset Sepsis/Meningitis (LOS) Event Report  Added a Report No Events section to several report types  Removed HAI Outpatient Procedure Component (OPC) Event Report  Updated Bloodstream Infection Report (BSI) with 4 new templates  Replaced pathogen codes  Updated, added and removed codes  Added a FHIR component for the new report (balloted separately) |
|  | October 2018 | Publication of STU 3.3 |

Contents

1 Introduction 14

1.1 Purpose 14

1.2 Relationship to Another Standard 14

1.3 Audience 14

1.4 Organization of the Guide (Volumes 1 and 2) 15

1.4.1 Volume 1 Introductory Material 15

1.4.2 Volume 2 CDA Templates and Supporting Material 15

1.4.3 Example Instance Identifiers 16

1.5 Contents of the Package 17

2 CDA and HAI Reporting 19

2.1 CDA R2 Background 19

2.2 Templated CDA 19

2.3 HAI Reporting Background 20

2.4 Current Release 21

2.5 Future Work 22

2.6 Change Notification Process 22

3 Design Considerations 23

3.1 Rendering Header Information for Human Presentation 23

3.2 Unknown and No Known Information 23

3.3 Negating Clinical Statements 27

3.4 Summary Document ServiceEvent Codes 28

4 Using This Implementation Guide 29

4.1 Levels of Constraint 29

4.2 Conformance Conventions Used in This Guide 29

4.2.1 Templates and Conformance Statements 29

4.2.2 Template Versioning 31

4.2.3 Open and Closed Templates 32

4.2.4 Conformance Verbs (Keywords) 33

4.2.5 Cardinality 33

4.2.6 Optional and Required with Cardinality 34

4.2.7 Vocabulary Conformance 34

4.2.8 Data Types 36

4.2.9 Succession Management 36

4.3 XML Conventions Used in This Guide 36

4.3.1 XPath Notation 36

4.3.2 XML Examples and Sample Documents 37

4.4 Supporting Tools 37

4.4.1 Validation 37

4.4.2 Generation of Narrative Block 38

4.4.3 Display Transforms 38

5 References 39

Appendix A — Acronyms and Abbreviations 40

Appendix B — High-Level Changes From Previous Releases 42

DSTU Release 3 42

DSTU Release 4 42

DSTU Release 4.1 42

DSTU Release 5 43

DSTU Release 6 43

DSTU Release 7 43

DSTU Release 8 43

DSTU Release 9 44

Normative Release 1 44

Normative Release 2, 1st DSTU 45

Normative Release 2, Update to 1st DSTU 45

Normative Release 2, 2nd DSTU 45

Normative Release 2, Update to 2nd DSTU 46

Normative Release 2, First Normative Ballot 47

Normative Release 3, 1st DSTU 47

Normative Release 3, Update to 1st DSTU 49

Normative Release 3, 2nd STU 50

Normative Release 3, 3rd STU 51

Appendix C — Document and Section Codes (Non-normative) 54

Appendix D — Consolidated CDA (C-CDA) Templates Referenced in This Guide 55

Appendix E — Example Instance Identifiers (Non-normative) 56

Appendix F — Vocabulary Heuristics for Codes and Value Sets (Non-normative) 58

Code and codeSystem Selection 58

Value Set Assignment and Maintenance 59

Figures

Figure 1: Templated CDA 20

Figure 2: nullFlavor Example 24

Figure 3: Attribute Required—nullFlavor not allowed 24

Figure 4: Allowed nullFlavors When Element is Required—with XML examples 25

Figure 5: Unknown Medication Example 25

Figure 6: Unknown Medication Use of Anticoagulant Drug Example 26

Figure 7: No Known Medications Example 26

Figure 8: Value Known—code for value not known 26

Figure 9: Value Completely Unknown 27

Figure 10: Value Known—code in required code system not known but code from another code system is known 27

Figure 11: Context Tables 30

Figure 12: Constraints Overview Table Example 30

Figure 13: Constraints Format Example 31

Figure 14: Versioned Template Change Log Example 32

Figure 15: Constraints Format—only one allowed 33

Figure 16: Constraints Format—only one like this allowed 34

Figure 17: Binding to a Single Code 34

Figure 18: XML Expression of a Single-code Binding 35

Figure 19: Example Value Set Table 35

Figure 20: XML Document Example 37

Figure 21: XPath Expression Example 37

Figure 22: ClinicalDocument Example 37

Tables

Table 1: Contents of the Package – Normative & Informative 17

Table 2: Contents of the Package – Informative Only 17

Table 2: Document and Section Codes 54

Table 3: C-CDA Template OIDs 55

Table 4: Structure of Example OIDs 56

Table 5: Values of Example Instance Identifiers Used in This Guide 57

# Introduction

## Purpose

The purpose of this implementation guide (IG) is to specify standards for electronic submission of Healthcare Associated Infection (HAI ) reports to the National Healthcare Safety Network (NHSN) of the Centers for Disease Control and Prevention (CDC). This multi-volume IG contains an overview of Clinical Document Architecture (CDA) markup standards, design, and use (Volume 1) and a library of CDA templates for electronic submission of HAI reports to the NHSN (Volume 2). Volumes 1 and 2 comprise this normative release.

Two stand-alone subsets (Volume 3 and Volume 4) provide guidance on topic-specific implementations: Antimicrobial Resistance (AR) and Antimicrobial Use (AU) data (Volume 3), and Hemovigilance (HV) data (Volume 4). Volumes 3 and 4 are informative only.

As reports are modified and new report types are defined, CDC and Health Level Seven (HL7) will develop and publish additional constraints. These will be included in the normative IG (Volumes 1 and 2), and may be the topics of future stand-alone subsets.

Throughout this process, CDC remains the authority on NHSN data collection protocols. When healthcare enterprises choose to participate in NHSN, they must report to CDC occurrences such as specific reportable procedures, even those without complications, and events such as a bloodstream infection, either confirmed by a positive blood culture or supported by a patient’s clinical symptoms. This specification opens the channel for data submission by all applications compliant with the data coding requirements defined here.

Note that participation in the NHSN requires enrollment and filing of reporting plans, which are not defined by this specification. For an overview of NHSN and full information on NHSN participation requirements, see: [nhsn](http://www.cdc.gov/nhsn/). Provisions of the Public Health Service Act protect all data reported to NHSN from discovery through the Freedom of Information Act (FOIA).

## Relationship to Another Standard

Starting in the May 2018 ballot cycle, HL7 has developed a FHIR Implementation Guide in parallel with the CDA Implementation Guide. This new standard includes all new forms as they are added to the HAI work. We anticipate several STU releases on the path to a Normative Release 1 of the *HL7 Implmentation Guide for FHIR: Healthcare Associated Infection Reports*. The FHIR and CDA implementation guides will align. A change to one standard will require the same change in the other standard. In this release, the new form included in both the CDA and FHIR standards is the Late Onset Sepsis/Meningitis Event (LOS) Report numerator.

## Audience

The audience for this work is all developers of software systems who want to enable their systems for reporting HAI data to the NHSN.

## Organization of the Guide (Volumes 1 and 2)

This *HL7 CDA® R2 Implementation Guide: NHSN Healthcare Associated Infection (HAI) Reports* is organized into four volumes. The first two volumes contain the entire guide:

* Volume 1 contains primarily narrative text describing the HAI guide.
* Volume 2 contains normative CDA template definitions.
* Volume 3 provides guidance on Single-Person (Numerator) and Summary (Denominator) Reports dealing with Antimicrobial Resistance (AR) and Antimicrobial Use (AU) data. The templates provided in this guide are a subset of those in Volume 2.
* Volume 4 provides guidance for the Hemovigilance (HV) Summary Report (Denominator). The templates provided in this guide are a subset of those in Volume 2.

The sections below describe the organization of the first two volumes; similar sections in Volumes 3 and 4 describe the structure of those documents.

### Volume 1 Introductory Material

This document, Volume 1, provides an overview of Clinical Document Architecture (CDA), recent changes to the standard, and information on how to understand and use the CDA templates provided in Volume 2.

* **Chapter 1—Introduction**
* **Chapter 2—CDA and HAI Reporting** contains project background and selected background material on the CDA Release 2 (CDA R2) base standard to aid the reader in conceptualizing the “templated CDA” approach to IG development.
* **Chapter 3—Design Considerations** describes overarching principles that have been developed and applied across the CDA templates in this guide. Material in this section can be thought of as “heuristics”, as opposed to the formal and testable constraints found in Volume 2 of this guide.
* **Chapter 4—Using This Implementation Guide** describes the rules and formalisms used to constrain the CDA R2 standard. It describes the formal representation of CDA templates, the mechanism by which templates are bound to vocabulary, and additional information necessary to understand and correctly implement the normative content found in Volume 2 of this guide.
* **Chapter 5—References**lists documents and sources cited by this guide.
* **Appendices** include acronyms and abbreviations, a high-level change log for this and all previous releases, a list of codes used by HAI reports, a list of Consolidated CDA (C-CDA) templates to which HAI templates conform, example instance identifiers, and vocabulary heuristics for code systems and value sets.

### Volume 2 CDA Templates and Supporting Material

Volume 2 includes CDA templates and prescribes their use for a set of specific document types. The main chapters are:

* **Chapter 1—Document-Level Templates** defines the report requirements for all HAI CDA documents.

The Healthcare Associated Infection Report requirements apply to any HAI CDA document. They apply to constraints on the CDA header and sections, and include the requirement that the body be represented by a structuredBody element.

The header requirements for population summary reports and for single-person reports differ significantly. HAI defines a generic header template for each of these two sets of requirements. Report-specific templates give additional requirements for each report type in this IG.

* **Chapter 2**—**Section-Level Templates** defines the generic constraints that apply to all sections along with specific requirements for each section used by the HAI reports in this guide.
* **Chapter 3**—**Entry-Level Templates** defines clinical statements. Machine processable data are sent in the entry templates. The entry templates are referenced by one or more section templates. Entry-level templates are always contained in section-level templates, and section-level templates are always contained in a document. Requirements for all entries (including organizers) used by the reports in this guide are in alphabetical order.
* **Chapter 4**—**Template IDs in This Guide** lists the template identifiers used by this guide for HAI reporting to NHSN. These template identifiers are assigned at the document, section, and entry level. Tables list NHSN templates by type and name and by containment. (Consolidated CDA (C-CDA) templates to which the NHSN templates conform are listed in Volume 1.)
* **Chapter 5**—**Value Sets in This Guide** lists all value set names and OIDs used by HAI templates. Links are provided to external value set sources if appropriate. Additionally, the hai\_voc.xls spreadsheet is provided as a resource for value-set information.
* **Chapter 6**—**Code Systems in This Guide** lists all code system names and OIDs used by HAI templates, both for value sets and single-value bindings.
* **Chapter 7**—**Changes From Previous Version** details all changes made in templates for this release. (A summary of changes in earlier releases is provided in Volume 1.)

### Example Instance Identifiers

Much of the initial development of this guide was driven by a pilot project in July 2007. The pilot project used object identifiers (OIDs) assigned to a fictional facility and vendor to illustrate the numbering schemes for which facilities and vendors are responsible.

Except for the example patient identifiers, the example code in this document and the accompanying sample files use these pilot OIDs. Example patient identifiers use the HL7 example OID. In practice, the identifiers will be assigned by facilities and software applications submitting reports to NHSN.

These pilot instance identifiers begin with 2.16.840.1.113883.3.117.1.1.5; HL7 example identifiers begin with 2.16.840.1.113883.19.5. They are used throughout this guide and are documented in the appendix on [Example Instance Identifiers (Non-normative).](#App_Example_Instance_Identifers)

## Contents of the Package

The following files comprise this package.

Table 1: Contents of the Package – Normative & Informative

|  |  |  |  |
| --- | --- | --- | --- |
| Filename | Description | Normative | Informative |
| CDAR2\_IG\_HAIRPT\_R3\_D3\_2018OCT \_V1\_Introductory\_Material.docx | Vol 1: Introductory material for this implementation guide | Chapter 1  Chapter 4  Appendix A  Appendix B | Chapter 2  Chapter 3  Chapter 5 |
| CDAR2\_IG\_HAIRPT\_R3\_D3\_2018OCT \_V2\_Templates\_and\_Supporting.docx | Vol 2: Normative CDA templates for this implementation guide | Templates  Appendices | Examples |
| CDAR2\_IG\_HAIRPT\_R3\_D3\_2018OCT \_V3\_AU\_AR\_Appendix.docx | Vol 3: Introductory material and CDA templates for antimicrobial-related templates in this guide | Templates  Appendices | Examples |
| CDAR2\_IG\_HAIRPT\_R3\_D3\_2018OCT \_V4\_HV\_Appendix.docx | Vol 4: Introductory material and CDA templates for hemovigilance-related templates in this guide | Templates  Appendices | Examples |

Table 2: Contents of the Package – Informative Only

|  |  |
| --- | --- |
| Filename | Description |
| hai\_voc.xlsx | Vocabulary spreadsheet |
| hai\_voc\_NRF.xlsx | Vocabulary spreadsheet – new release format |
| **Sample files** | |
| bsi-num.xml | Bloodstream infection (BSI) numerator |
| ssi-num.xml | Surgical site infection (SSI) numerator |
| uti-num.xml | Urinary tract infection (UTI) numerator |
| proc-denom.xml | Procedure denominator |
| clip-num.xml | Central-line insertion practice (CLIP) numerator |
| lio-num.xml | Laboratory-identified organism (LIO) numerator |
| eoid-num.xml | Dialysis numerator |
| aro-num.xml | Antimicrobial Resistance Option (ARO) numerator |
| vae-num.xml | Ventilator Associated Event (VAE) numerator |
| los-num.xml | Late Onset Sepsis/Meningitis Event (LOS) Report numerator |
| pop\_sum-denom.xml | Summary data – denominator (example for ICU/Other) |
| pop\_sum-denom-NICU.xml | Summary data – denominator (example for Neonatal Intensive Care Unit [NICU]) |
| pop\_sum-denom-POM-FACWIDEOUT.xml | Summary data – denominator for prevention process and outcome measures monthly monitoring (POM) for facility-wide out-patient data |
| pop\_sum-denom-POM-FACWIDEIN.xml | Summary data – denominator for prevention process and outcome measures monthly monitoring (POM) for facility-wide in-patient data |
| pop\_sum-denom-AUP.xml | Summary data – denominator for antimicrobial usage |
| pop-sum-denom-SCA.xml | Summary data – denominator for specialty care area |
| pop-sum-denom-VAT.xml | Summary data – denominator for chronic hemodialysis patients |
| pop-sum-denom-ARO.xml | Summary data – denominator for antimicrobial resistance option (ARO) |
| pop-sum-denom-HV.xml | Summary data – denominator for hemovigilance reporting (HV) |
| pop-sum-denom-HP-FLU.xml | Summary data – denominator for Influenza vaccination reporting (HP-FLU) |

# CDA and HAI Reporting

## CDA R2 Background

This implementation guide uses the *HL7 Clinical Document Architecture, Release 2.0 (CDA R2)* as its base standard.[[1]](#footnote-2) CDA R2 is “… a document markup standard that specifies the structure and semantics of ‘clinical documents’ for the purpose of exchange” [CDA R2, Section 1.1]. Clinical documents, according to CDA, have the following characteristics:

* Persistence
* Stewardship
* Potential for authentication
* Context
* Wholeness
* Human readability

CDA defines a header for classification and management, and a document body that carries the clinical record. While the header metadata are prescriptive and designed for consistency across all instances, the body is highly generic, leaving the designation of semantic requirements to implementation.

## Templated CDA

CDA R2 can be constrained by mechanisms defined in the “Refinement and Localization”[[2]](#footnote-3) section of the *HL7 Version 3 Interoperability Standards*. The mechanism most commonly used to constrain CDA is referred to as “templated CDA”. In this approach, a library is created containing modular CDA templates such that the templates can be reused across any number of CDA document types, as shown in the following figure.

Figure 1: Templated CDA



Many different kinds of templates may be created. Among them, the most common are:

* **Document-level templates:** These templates constrain fields in the CDA header, and define containment relationships to CDA sections. For example, a History and Physical document-level template might require that the patient’s name be present, and that the document contain a Physical Exam section.
* **Section-level templates:** These templates constrain fields in the CDA section, and define containment relationships to CDA entries. For example, a Physical Exam section-level template might require that the section/code be fixed to a particular LOINC code, and that the section contain a Systolic Blood Pressure observation.
* **Entry-level templates:** These templates constrain the CDA clinical statement model in accordance with real world observations and acts. For example, a Systolic Blood Pressure entry-level template defines how the CDA Observation class is constrained (how to populate observation/code, how to populate observation/value, etc.) to represent the notion of a systolic blood pressure.

A CDA implementation guide (such as this one) includes reference to those templates that are applicable. On the implementation side, a CDA instance populates the template identifier (templateId) field to assert conformance to a given template. On the receiving side, the recipient can not only test the instance for conformance against the CDA XML (Extensible Markup Language) schema, but can also test the instance for conformance against asserted templates.

Template identifiers are critical to the validation methods chosen for submissions to the NHSN. NHSN may reject as nonconformant instances that do not conform to the template identifier constraints defined here.

Please reference the NHSN webpage ([nhsn](http://www.cdc.gov/nhsn/)) to identify which HAI release NHSN currently supports for a given report type.

## HAI Reporting Background

The CDA specification for HAI reporting was first released in 2008. It provided guidance on four reports: Blood Stream Infection (BSI) Report, Surgical Site Infection (SSI) Report, Procedure Report, and Intensive Care Unit (ICU)/Other Locations (not Neonatal Intensive Care Unit [NICU] or Specialty Care Area [SCA]) Report. Since 2008, this IG has been updated and expanded every year, going through the HL7 ballot comment and reconciliation process each time.

Subsequent releases added new report types and extended the population summary report to encompass additional data sets, including for the NHSN Antimicrobial Use and Resistance (AUR) Module, which contains two options for facilities, one focused on AU reporting and the second focused on AR reporting. Facilities participate in one or both options. For an overview of the changes in each release, see [Revision History](#T_Revision_History) table in the appendix [High-Level Changes from Previous Releases](#App_Changes_in_Previous_DSTU_Releases).

## Current Release

This implementation guide is the third STU release of the third normative release of the HAI reporting templates. It adds one new report, revises six reports, removes (i.e., retires) two reports, revises two templates, adds eleven templates, revises seven value sets, and adds eight new value sets.

This guide templates nineteen HAI report types.

**HAI Population Summary Reports:**

1. Antimicrobial Resistance Option (ARO) Summary Report (V2)
2. Antimicrobial Use (AUP) Summary Report (V2)
3. Healthcare Personnel Influenza Vaccination (HP-FLU) Summary Report
4. Hemovigilance (HV) Summary Report (V2)
5. Intensive Care Unit (ICU) Summary Report (V2)
6. Neonatal Intensive Care Unit (NICU) Summary Report (V2)
7. Prevention Process and Outcome Measures (POM) Summary Report (V2)
8. Specialty Care Area (SCA) Summary Report (V2)
9. Vascular Access Type Report (VAT) Summary Report (V2)

**HAI Single-Person Report Generic Constraints**

1. HAI AUR Antimicrobial Resistance Option (ARO) Report (V4)
2. HAI Bloodstream Infection Report (BSI) (V2)
3. HAI Central-Line Insertion Practice Numerator Report (V2)
4. HAI Evidence of Infection (Dialysis) Report (V5)
5. HAI Laboratory-Identified Organism (LIO) Report (V2)
6. HAI Procedure Denominator Report (V2)
7. HAI Surgical Site Infection Report (SSI) (V2)
8. HAI Urinary Tract Infection Numerator Report (UTI)
9. Ventilator Associated Event (VAE) Report
10. Late Onset Sepsis/Meningitis Event (LOS) Report

Changes made in this release are summarized in the Appendix [High-Level Changes from Previous Releases](#App_Changes_in_Previous_DSTU_Releases). When new versions of templates appear for the first time in the implementation guide, Volumes 2, 3, and 4 of this guide contain detailed sections on “Changes from Previous Version”.

## Future Work

Future work on HAI reporting will continue to expand the set of forms covered by the specification.

## Change Notification Process

CDC maintains an e-mail list of contacts at organizations interested in or responsible for implementations of CDA for HAI reporting to NHSN. To be added to the list, send a request with your contact information to [nhsncda@cdc.gov](mailto:nhsncda@cdc.gov). CDC uses the list for e-mail notifications of changes, including new data requirements. Changes may apply to this IG and to other documents such as business rules that are needed to implement and support CDA for HAI reporting to NHSN. NHSN CDA related information may be found at [CDA Portal](https://www.cdc.gov/nhsn/cdaportal/index.html).

# Design Considerations

Design considerations describe overarching principles that have been developed and applied across the CDA templates in this guide. Material in this section can be thought of as “heuristics”, as opposed to the formal and testable constraints found in Volume 2 of this guide. Volumes 3 and 4 contain both heuristics and subsets of the testable constraints.

## Rendering Header Information for Human Presentation

Metadata carried in the header may already be available for rendering from electronic health records (EHRs) or other sources external to the document, therefore, there is no strict requirement to render directly from the document. An example of this would be a doctor using an EHR that already contains the patient’s name, date of birth, current address, and phone number. When a CDA document is rendered within that EHR, those pieces of information may not need to be displayed since they are already known and displayed within the EHR’s user interface.

Good practice recommends that the following be present whenever the document is viewed:

* Document title and document dates
* Service and encounter types, and date ranges as appropriate
* Names of all persons along with their roles, participations, participation date ranges, identifiers, address, and telecommunications information
* Names of selected organizations along with their roles, participations, participation date ranges, identifiers, address, and telecommunications information
* Date of birth for recordTarget(s)

## Unknown and No Known Information

Information technology solutions store and manage data, but sometimes data are not available. An item may be unknown, not relevant, or not computable or measurable, such as where a patient arrives at an Emergency Department unconscious and with no identification.

In many cases, the CDA standard will stipulate that a piece of information is required (e.g., via a SHALL conformance verb). However, in most of these cases, the standard provides an “out”, allowing the sender to indicate that the information isn’t known.

Here, we provide guidance on representing unknown information. Further details can be found in the HL7 V3 Data Types, Release One specification that accompanies the CDA R2 normative standard.

A “@nullFlavor” attribute may be used to indicate that information is unknown. Allowable values for populating the attribute give more details about the reason the information is unknown, as shown in the following example.

Figure 2: nullFlavor Example

<!-- CDA requires the consumable element, however NHSN does not

collect further information about the antifungal -->

<consumable>

<manufacturedProduct>

<templateId root="2.16.840.1.113883.10.20.22.4.37"/>

<manufacturedMaterial>

<code nullFlavor="NI"/>

</manufacturedMaterial>

</manufacturedProduct>

</consumable>

Use null flavors for unknown, required, or optional attributes, where allowed per the NHSN protocol:

NI No information. This is the most general and default null flavor.

NA Not applicable. Known to have no proper value (e.g., last menstrual period for a male).

UNK Unknown. A proper value is applicable, but is not known.

ASKU Asked, but not known. Information was sought, but not found (e.g., the patient was asked but did not know).

NAV Temporarily unavailable. The information is not available, but is expected to be available later.

NASK Not asked. The patient was not asked.

MSK There is information on this item available but it has not been provided by the sender due to security, privacy, or other reasons. There may be an alternate mechanism for gaining access to this information.

OTH The actual value is not an element in the value domain of a variable. (e.g., concept not provided by required code system).

The list above contains those null flavors that are commonly used in clinical documents. For the full list and descriptions, see the nullFlavor vocabulary domain in the CDA R2 normative standard.

Unless a nullFlavor is explicitly stated in a constraint in the IG, nullFlavors are not allowed.

Figure 3: Attribute Required—nullFlavor not allowed

1. SHALL contain exactly one [1..1] code (CONF:15407).

a. This code SHALL contain exactly one [1..1] @code="11450-4" Problem List   
 (CodeSystem: LOINC 2.16.840.1.113883.6.1) (CONF:15408).

or

2**.** SHALL contain exactly one [1..1] **effectiveTime/@value** (CONF:5256).

Figure 4: Allowed nullFlavors When Element is Required—with XML examples

1. SHALL contain at least one [1..\*] id

2. SHALL contain exactly one [1..1] code

3. SHALL contain exactly one [1..1] effectiveTime

<entry>

<observation classCode="OBS" moodCode="EVN">

<id nullFlavor="**NI**"/>

<code nullFlavor="**OTH**">

<originalText>New Grading system</originalText>

</code>

<statusCode code="completed"/>

<effectiveTime nullFlavor="**UNK**"/>

<value xsi:type="CD" nullFlavor="OTH">

<originalText>Spiculated mass grade 5</originalText>

</value>

</observation>

</entry>

If a sender wants to state that a piece of information is unknown, the following principles apply:

1. If the sender doesn’t know an attribute of an act, that attribute can be null.

Figure 5: Unknown Medication Example

<entry>

**<text>patient was given a medication but I do not know what it was</text>**

<substanceAdministration moodCode="EVN" classCode="SBADM">

<consumable>

<manufacturedProduct>

<manufacturedLabeledDrug>

<code **nullFlavor="NI"**/>

</manufacturedLabeledDrug>

</manufacturedProduct>

</consumable>

</substanceAdministration>

</entry>

2. If the sender doesn’t know if an act occurred, the nullFlavor is on the act (detail could include specific allergy, drug, etc.).

Figure 6: Unknown Medication Use of Anticoagulant Drug Example

<entry>

<substanceAdministration moodCode="EVN" classCode="SBADM" **nullFlavor="NI">**

**<text>I do not know whether or not patient received an anticoagulant**

**drug</text>**

<consumable>

<manufacturedProduct>

<manufacturedLabeledDrug>

**<code code="81839001" displayName="anticoagulant drug"**

**codeSystem="2.16.840.1.113883.6.96"**

**codeSystemName="SNOMED CT"/>**

</manufacturedLabeledDrug>

</manufacturedProduct>

</consumable>

</substanceAdministration>

</entry>

3. If the sender wants to state ‘no known’, a negationInd can be used on the corresponding act (substanceAdministration, Procedure, etc.)

Figure 7: No Known Medications Example

<entry>

<substanceAdministration moodCode="EVN" classCode="SBADM" **negationInd=”true”>**

**<text>No known medications</text>**

<consumable>

<manufacturedProduct>

<manufacturedLabeledDrug>

**<code code="410942007" displayName="drug or medication"**

**codeSystem="2.16.840.1.113883.6.96"**

**codeSystemName="SNOMED CT"/>**

</manufacturedLabeledDrug>

</manufacturedProduct>

</consumable>

</substanceAdministration>

</entry>

These next examples illustrate additional nuances of representing unknown information in coded fields.

Figure 8: Value Known—code for value not known

<entry>

<observation classCode="OBS" moodCode="EVN">

...

<value xsi:type="CD" nullFlavor="OTH">

<originalText>Spiculated mass grade 5</originalText>

</value>

</observation>

</entry>

Figure 9: Value Completely Unknown

<entry>

<observation classCode="OBS" moodCode="EVN">

...

<value xsi:type="CD" nullFlavor="UNK"/>

</observation>

</entry>

Figure 10: Value Known—code in required code system not known but code from another code system is known

<entry>

<observation classCode="OBS" moodCode="EVN">

...

<value xsi:type="CD" nullFlavor="OTH">

<originalText>Spiculated mass grade 5</originalText>

<translation code="129742005" displayName="spiculated lesion"

codeSystem="2.16.840.1.113883.6.96"

codeSystemName="SNOMED CT"/>/>

</value>

</observation>

</entry>

## Negating Clinical Statements

Usually, clinical statements in a CDA document assert positive statements. A procedure element represents a procedure that took place and an observation represents an observation about a patient condition or a lab result. In this implementation guide, when negationInd is set to true, it is understood that it negates the act as described by the act’s descriptive properties (including act.code, procedure.effectiveTime, observation.value, etc.) and any of the act’s components, rather than at the level of a specific value in the act. The inert properties such as act.id, act.moodCode, and act.confidentialityCode are not negated and always have the same meaning. In other words, when an act is negated, it indicates that the event as specified did not occur. For example, if the clinical statement is asserting that a wrong procedure has been performed on a certain date and its negationInd is set to true, the whole clinical statement is negated, including any attributes such as the assertion and the effectiveTime. This clinical statement indicates that we are not asserting that this event occurred on this date—there is no assertion that a wrong procedure was performed on this date. For further details and examples, see the definition of Act.negationInd in the HL7 Reference Information Model (RIM), Version 2.07 (the version of the HL7 RIM from which CDA, Release 2 is derived) and the discussion of *Negation Indicators in RIM Classes* in *Core Principles and Properties of V3 Models*.

## Summary Document ServiceEvent Codes

For all the summary reports, the documentationOf/serviceEvent/code element records the type of summary data reported. This corresponds to the NHSN form type. This pattern is similar to that used in C-CDA (all releases) (e.g., Operative Note).

# Using This Implementation Guide

This chapter describes the rules and formalisms used to constrain the CDA R2 standard. It describes the formal representation of CDA templates, the mechanism by which templates are bound to vocabulary, and additional information necessary to understand and correctly implement the normative content found in Volume 2 (and Volumes 3 and 4) of this guide.

## Levels of Constraint

The CDA standard describes conformance requirements in terms of three general levels corresponding to three different, incremental types of conformance statements:

* Level 1 requirements impose constraints upon the CDA Header. The body of a Level 1 document may be XML or an alternate allowed format. If XML, it must be CDA-conformant markup.
* Level 2 requirements specify constraints at the section level of a CDA XML document: most critically, the section code and the cardinality of the sections themselves, whether optional or required.
* Level 3 requirements specify constraints at the entry level within a section. A specification is considered “Level 3” if it requires any entry-level templates.

Note that these levels are rough indications of what a recipient can expect in terms of machine-processable coding and content reuse. They do not reflect the level or type of clinical content, and many additional levels of reusability could be defined.

The section libraries for each document type list the required and optional sections.

## Conformance Conventions Used in This Guide

### Templates and Conformance Statements

Conformance statements within Volumes 2, 3, and 4 of this implementation guide are presented as constraints from Trifolia Workbench, a template repository. An algorithm converts constraints recorded in Trifolia to a printable presentation. Each constraint is uniquely identified by an identifier at or near the end of the constraint (e.g., CONF:86-7345). The digits in the conformance number before the hyphen identify which IG the template belongs to and the number after the hyphen is unique to the owning IG. Together, these two numbers uniquely identify each constraint. These identifiers are persistent but not sequential. Conformance numbers in this guide associated with a conformance statement that is carried forward from a previous version of this guide will carry the same conformance number from the previous version. This is true even if slightly edited. If a conformance statement is entirely new, it will have a new conformance number.

Bracketed information following each template title indicates the template type (section, observation, act, procedure, etc.), the identifier oid or identifier urn, and whether the template is [open or closed](#IG_S_Open_and_Closed_Templates). The identifier oid is the templateId/@root value; all templateIds have an @root value. Newer and/or versioned templates also have an @extension value, which is a date identifying the version of this template; such templates are identified by urn and the HL7 version (urn:hl7ii). The urn identifier includes both the @root and @extension value for the templateId (for example, identifier urn:hl7ii:2.16.840.1.113883.10.20.5.5.41:2014-06-09).

Each section and entry template in Volumes 2, 3, and 4 of this guide includes a context table. The "Contained By" column indicates which templates use this template, and if the template is optional or required in the containing template. The "Contains" column indicates any templates that the template uses.

Figure 11: Context Tables

***XXX: Allergy Problem Act (V2) Contexts***

| Contained By: | Contains: |
| --- | --- |
| Allergies Section (entries optional) (V2) (optional)  Allergies Section (entries required) (V2) (required) | Allergy - Intolerance Observation (V2)  Author Participation |

Each template also includes a constraint overview table to summarize the constraints in the template.

Figure 12: Constraints Overview Table Example

| XPath | Card. | Verb | Data Type | CONF# | Fixed Value |
| --- | --- | --- | --- | --- | --- |
| observation[identifier: oid:2.16.840.1.113883.10.20.22.4.31] | | | | | |
| @classCode | 1..1 | SHALL |  | XXXX | 2.16.840.1.113883.5.6 (HL7ActClass) = OBS |
| @moodCode | 1..1 | SHALL |  | XXXX | 2.16.840.1.113883.5.1001 (ActMood) = EVN |
| code | 1..1 | SHALL |  | XXXX |  |
| @code | 1..1 | SHALL |  | XXXX | 2.16.840.1.113883.6.96 (SNOMED CT) = 445518008 |
| value | 1..1 | SHALL | PQ | XXXX |  |
| @unit | 1..1 | SHALL | CS | XXXX | 2.16.840.1.113883.11.20.9.21 (AgePQ\_UCUM) |
| templateId | 1..1 | SHALL |  | XXXX |  |
| @root | 1..1 | SHALL |  | XXXX | 2.16.840.1.113883.10.20.22.4.31 |
| statusCode | 1..1 | SHALL |  | XXXX |  |
| @code | 1..1 | SHALL |  | XXXX | 2.16.840.1.113883.5.14 (ActStatus) = completed |

The following figure shows a typical template’s set of constraints presented in Volumes 2, 3, and 4 of this guide. The next chapters describe specific aspects of conformance statements—open vs. closed statements, conformance verbs, cardinality, vocabulary conformance, containment relationships, and null flavors. The expression “such that it” means, you (SHALL/SHOULD/MAY) have one of those things that look like that, but you can also have another one of those things that look different. The example below states that you must have templateId with a root of 2.16.840.1.113883.10.20.22.4.31 but you can also have other template identifiers (IDs).

Figure 13: Constraints Format Example

***Age Observation***

[observation: identifier oid:2.16.840.1.113883.10.20.22.4.31(open)]

1. SHALL contain exactly one [1..1] @classCode="OBS" Observation (CodeSystem: HL7ActClass 2.16.840.1.113883.5.6 STATIC) (CONF:XXXX).
2. SHALL contain exactly one [1..1] @moodCode="EVN" Event (CodeSystem: ActMood 2.16.840.1.113883.5.1001 STATIC) (CONF: XXXX).
3. SHALL contain exactly one [1..1] templateId (CONF:XXXX) such that it
   1. SHALL contain exactly one [1..1] @root="2.16.840.1.113883.10.20.22.4.31" (CONF: XXXX).
4. SHALL contain exactly one [1..1] code (CONF:7615).
   1. This code SHALL contain exactly one [1..1] @code="445518008" Age At Onset (CodeSystem: SNOMED CT 2.16.840.1.113883.6.96 STATIC) (CONF: XXXX).
5. SHALL contain exactly one [1..1] statusCode (CONF: XXXX).
   1. This statusCode SHALL contain exactly one [1..1] @code="completed" Completed (CodeSystem: ActStatus 2.16.840.1.113883.5.14 STATIC) (CONF: XXXX).
6. SHALL contain exactly one [1..1] value with @xsi:type="PQ" (CONF:XXXX).
   1. This value SHALL contain exactly one [1..1] @unit, which SHALL be selected from ValueSet AgePQ\_UCUM 2.16.840.1.113883.11.20.9.21 DYNAMIC (CONF: XXXX).

### Template Versioning

A new version of an existing implementation guide reuses templates from the previous version. During the ballot phase or update phase, templates carry the designation “Published as part of <name of IG>” to indicate the template is unchanged from the previous version or “Draft as part of <name of IG>” to indicate a new or revised template.

If there are no substantive changes to a template that has been successfully published, the template will carry the same templateId/@root (identifier oid) and templateId/@extension as in the previous implementation guide (in the case of older templates, the @extension attribute will not be present). During a new ballot or update phase, “Published as part of <name of IG>” is appended to the main heading for the template to indicate that the template cannot be commented on in the ballot or update.

A revised version of a previously published template keeps the same templateId/@root as the previous version, but it is assigned a new templateId/@extension. The notation “(Vn)” (V2, V3, etc.) is also added to the template name. Versions are not necessarily forward or backward compatible. A versioning may be due to substantive changes in the template and/or the fact that a contained template has changed. The “(Vn)” designation is persistent; it appears with that template when it is used in subsequent guides. During a new ballot or update phase, “Draft as part of <name of IG>” is appended to the main heading for the template to indicate that it may be voted on in the ballot or commented on in the update; this “Draft as part of <name of IG>” designation is updated to "Published as part of <name of IG> in final publication versions.

A revised version of a template is explicitly linked to the prior version. When a new version appears for the first time in an IG, a detailed change log is automatically generated. All such changes for a given IG are shown in Volume 2 (and Volumes 3 and 4), Section 6 “Changes From Previous Version”.

The following figure shows an example of a versioned template: HAI AUR Antimicrobial Resistance Option (ARO) Report (oid:2.16.840.1.113883.10.20.5.31) has versioned to HAI AUR Antimicrobial Resistance Option (ARO) Report (V2) (urn:hl7ii:2.16.840.1.113883.10.20.5.31:2014-06-09).

Figure 14: Versioned Template Change Log Example

| Change | Old | New |
| --- | --- | --- |
| Name | HAI AUR Antimicrobial Resistance Option (ARO) Report | HAI AUR Antimicrobial Resistance Option (ARO) Report (V2) |
| Oid | oid:2.16.840.1.113883.10.20.5.31 | urn:hl7ii:2.16.840.1.113883.10.20.5.31:2014-06-09 |
| CONF #: 1129-30474 Added |  | SHALL contain exactly one [1..1] @extension="2014-06-09" (CONF:1129-30474). |
| CONF #: 1129-21153 Modified | SHALL contain exactly one [1..1] Findings Section in an ARO Report (identifier: oid:2.16.840.1.113883.10.20.5.5.32) | SHALL contain exactly one [1..1] Findings Section in an ARO Report (V2) (identifier: urn:hl7ii:2.16.840.1.113883.10.20.5.5.32:2014-06-09) |

### Open and Closed Templates

HAI templates are, with one exception, closed templates. This means that the template constraints specify everything that is allowed. In open templates, by contrast, all of the features of the CDA R2 base specification are allowed except as constrained by the templates.

The exception to closed templates in HAI reports is that the structuredBody is open: it may contain sections not specified in this guide. The content of such unspecified sections is not processed by NHSN.

### Conformance Verbs (Keywords)

The keywords shall, should, may, need not, should not, and shall not in this document are to be interpreted as described in the HL7 Version 3 Publishing Facilitator's Guide.[[3]](#footnote-4)

* shall: an absolute requirement
* shall not: an absolute prohibition against inclusion
* should/should not: best practice or recommendation. There may be valid reasons to ignore an item, but the full implications must be understood and carefully weighed before choosing a different course
* may/need not: truly optional; can be included or omitted as the author decides with no implications

The keyword "shall" allows the use of nullFlavor unless the requirement is on an attribute or the use of nullFlavor is explicitly precluded.

### Cardinality

The cardinality indicator (0..1, 1..1, 1..\*, etc.) specifies the allowable occurrences within a document instance. The cardinality indicators are interpreted with the following format “m…n” where m represents the least and n the most:

* 0..1 zero or one
* 1..1 exactly one
* 1..\* at least one
* 0..\* zero or more
* 1..n at least one and not more than n

When a constraint has subordinate clauses, the scope of the cardinality of the parent constraint must be clear. In the next figure, the constraint says exactly one participant is to be present. The subordinate constraint specifies some additional characteristics of that participant.

Figure 15: Constraints Format—only one allowed

1. SHALL contain exactly one [1..1] **participant** (CONF:2777).

a. This participantSHALL contain exactly one [1..1] **@typeCode**="LOC"   
 (CodeSystem: 2.16.840.1.113883.5.90 HL7ParticipationType)   
 (CONF:2230).

In the next figure, the constraint says only one participant “like this” is to be present. Other participant elements are not precluded by this constraint.

Figure 16: Constraints Format—only one like this allowed

1. SHALL contain exactly one [1..1] **participant** (CONF:2777) such that it

a. SHALL contain exactly one [1..1] **@typeCode**="LOC" (CodeSystem:

2.16.840.1.113883.5.90 HL7ParticipationType) (CONF:2230).

### Optional and Required with Cardinality

The terms *optional* and *required* describe the *lower* bound of cardinality as follows:

*Optional* means that the number of allowable occurrences of an element may be 0; the cardinality will be expressed as [0..1] or [0..\*] or similar. In these cases, the element may not be present in the instance.

*Required* means that the number of allowable occurrences of an element must be at least 1; the cardinality will be expressed as [m..n] where m >=1 and n >=m for example [1..1] or [1..\*]. In these cases, the element must be present in the instance. If an element is required, but is not known (and would otherwise be omitted if it were optional), it must be represented by a null flavor. See “[Unknown and No Known Information”](#IG_S_Unknown_and_No_Known_Information).

### Vocabulary Conformance

The templates in this document use terms from several code systems. These vocabularies are defined in various supporting specifications and may be maintained by other bodies, as is the case for the LOINC and SNOMED CT vocabularies.

Note that value-set identifiers (e.g., ValueSet 2.16.840.1.113883.1.11.78 Observation Interpretation (HL7) **DYNAMIC)** do not appear in CDA submissions; they tie the conformance requirements of an implementation guide to the appropriate code system for validation.

Value-set bindings adhere to HL7 Vocabulary Working Group best practices, and include both a conformance verb (shall, should, may, etc.) and an indication of dynamic vs. static binding. Value-set constraints can be static, meaning that they are bound to a specified version of a value set, or dynamic, meaning that they are bound to the most current version of the value set. A simplified constraint, used when the binding is to a single code, includes the meaning of the code, as follows.

Figure 17: Binding to a Single Code

2. SHALL contain exactly one [1..1] code (CONF:15403).

a) This code SHALL contain exactly one [1..1] @code="11450-4" Problem List

(CONF:15408).

b) This code SHALL contain exactly one [1..1] @codeSystem="2.16.840.1.113883.6.1"

(CodeSystem: LOINC 2.16.840.1.113883.6.1 STATIC) (CONF: 31141).

The notation conveys the actual code (11450-4), the code’s displayName (Problem List), the OID of the codeSystem from which the code is drawn (2.16.840.1.113883.6.1), and the codeSystemName (LOINC).

HL7 Data Types Release 1 requires the codeSystem attribute unless the underlying data type is “Coded Simple” or “CS”, in which case it is prohibited. The displayName and the codeSystemName are optional, but recommended, in all cases.

The above example would be properly expressed as follows.

Figure 18: XML Expression of a Single-code Binding

<code code="11450-4" codeSystem="2.16.840.1.113883.6.1"/>

<!-- or -->

<code code="11450-4" codeSystem="2.16.840.1.113883.6.1"

displayName="Problem List"

codeSystemName=”LOINC”/>

A full discussion of the representation of vocabulary is outside the scope of this document; for more information, see the *HL7 V3 Normative Edition 2010*[[4]](#footnote-5) sections on Abstract Data Types and XML Data Types R1.

Value set tables are presented below the first template that uses that value set; links are provided in subsequent templates that use the same value set. The value set tables include the value set identifier, a description, a link (where appropriate), and a list of codes in the value set. Ellipses in the last row of value-set members shown indicate that the list is an excerpt and the complete source must be accessed to see all members. Where the table is an excerpt and no link is provided, the full set of values are contained in the hai\_voc.xls spreadsheet included with this package.

Figure 19: Example Value Set Table

|  |  |  |  |
| --- | --- | --- | --- |
| Value Set: Referral Types 2.16.840.1.113883.11.20.9.56  A value set of SNOMED CT codes descending from "3457005" patient referral (procedure).  Value Set Source: https://vsac.nlm.nih.gov | | | |
| Code | Code System | Code System OID | Print Name |
| 44383000 | SNOMED CT | 2.16.840.1.113883.6.96 | Patient referral for consultation |
| 391034007 | SNOMED CT | 2.16.840.1.113883.6.96 | Refer for falls assessment (procedure) |
| 86395003 | SNOMED CT | 2.16.840.1.113883.6.96 | Patient referral for family planning (procedure) |
| 306106002 | SNOMED CT | 2.16.840.1.113883.6.96 | Referral to intensive care service (procedure) |
| 306140002 | SNOMED CT | 2.16.840.1.113883.6.96 | Referral to clinical oncology service (procedure) |
| 396150002 | SNOMED CT | 2.16.840.1.113883.6.96 | Referral for substance abuse (procedure) |
| ... |  |  |  |

### Data Types

All data types used in a CDA document are described in the CDA R2 normative standard. All attributes of a data type are allowed unless explicitly prohibited by this specification.

### Succession Management

CDA-conformant HAI instances use the elements defined in the CDA header (documentId, setId, version number, and relatedDocument/typeCode) to manage replacements and updates of the documents. As with all CDA documents, the ClinicalDocument/id uniquely identifies a document instance (an electronic file). Incremented version numbers identify subsequent versions of the document.

NHSN assigns each participating facility a root OID. The vendor system generates the ClinicalDocument/setId. The vendor is responsible for extending its OID as necessary to support the several unique numbering schemes it must generate; these include document identifiers and facility-generated procedure identifiers.

## XML Conventions Used in This Guide

### XPath Notation

Instead of the traditional dotted notation used by HL7 to represent RIM classes, this document uses XML Path Language (XPath) notation[[5]](#footnote-6) in conformance statements and elsewhere to identify the XML elements and attributes within the CDA document instance to which various constraints are applied. The implicit context of these expressions is the root of the document. This notation provides a mechanism that will be familiar to developers for identifying parts of an XML document.

XPath statements appear in this document in a monospace font.

XPath syntax selects nodes from an XML document using a path containing the context of the node(s). The path is constructed from node names and attribute names (prefixed by a ‘@’) and catenated with a ‘/’ symbol.

Figure 20: XML Document Example

<author>

<assignedAuthor>

...

<code codeSystem='2.16.840.1.113883.6.96'

codeSystemName='SNOMED CT'

code='17561000'

displayName='Cardiologist' />

...

</assignedAuthor>

</author>

In the above example, the code attribute of the code could be selected with the XPath expression in the next figure.

Figure 21: XPath Expression Example

author/assignedAuthor/code/@code

### XML Examples and Sample Documents

XML examples appear in figures in this document in this monospace font. Portions of the XML content may be omitted from the content for brevity, marked by an ellipsis (...) as shown in the example below.

Figure 22: ClinicalDocument Example

<ClinicalDocument xmls="urn:h17-org:v3">

...

</ClinicalDocument>

Within the narrative, XML element (code, assignedAuthor, etc.) and attribute (SNOMED CT, 17561000, etc.) names also appear in this monospace font.

This package includes sample documents as listed in the [Contents of the Package](#T_Contents_of_the_Package) table.

## Supporting Tools

### Validation

This guide expresses CDA R2 constraints and provides a non-normative set of Schematron schemas based on a technology-neutral formalism, which can test template conformance.

Schematron is “a language for making assertions about patterns found in XML documents.” The schemas provided for CDA and for this package support two-stage validation. First, the CDA schema CDA.xsd validates the basic structural and semantic requirements of any CDA instance. Second, the IG-specific Schematron schema validates the specific requirements of this package.

Validation services are provided through the NHSN import mechanism and by Lantana Group’s CDA Validator ([lantana validator](https://www.lantanagroup.com/validator/)). The CDA Validator is an online application that validates a CDA document’s conformance to several standards and implementation guides; it includes the Schematron files described above.

### Generation of Narrative Block

Clinical documents generated by clinicians for a patient chart can assume an almost infinite set of semantic structures. For this reason, CDA relies on a narrative block (section/text) to convey the comprehensive clinical report, i.e., all the information that a human reader would consider the definitive, legal content of the record. (Human readability and rendering requirements are described in CDA R2, Section 1.2.3. See [References](#IG_S_References).)

In contrast, the structure and semantics of HAI reports to the NHSN are tightly constrained for unambiguous insertion into the NHSN database. Few elements allow unstructured, uncoded narrative. The definitive, human-readable, legal contents of a report can be derived entirely from the CDA titles and coded entries. Therefore, for the convenience of implementers, this project created a transform that derives the narrative block from the CDA entries. Use of this transform is not required; implementers can use local methods to create the CDA narrative block.

### Display Transforms

The content required for correct interpretation by a human reader of a compliant instance must be displayable using any CDA stylesheet. Thus, instances conforming to this IG can be viewed using CDA.xsl or any other stylesheet.

In addition, this project has a customized stylesheet that conforms more closely to the display format typical of such records.

# References

* CDA Validator, [http://www.lantanagroup.com/validator.](http://www.lantanagroup.com/validator)
* *HL7 Clinical Document Architecture, Release 2 (CDA R2), Normative Edition.* (May 2005). [HL7](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7)
* *HL7 Implementation Guide for CDA Release 2.0, Consolidated CDA Templates, R1.1 (US Realm).* [hl7 standards](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=258)
* *HL7 Version 3 Interoperability Standards,* Normative Edition 2010. [http://www.hl7.org/memonly/downloads/v3edition.cfm - V32010](http://www.hl7.org/memonly/downloads/v3edition.cfm#V32010)
* *HL7 Version 3 Publishing Facilitator’s Guide,* Release 1. (2005). [v3 ballot](http://www.hl7.org/v3ballot/html/help/pfg/pfg.htm) (Login required)
* *HL7 Version 3 Standard: Refinement, Constraint and Localization to Version 3 Messages, Release 2* (9/9/2015). [conformance](http://www.hl7.org/v3ballot/html/infrastructure/conformance/conformance.htm) (Login required)
* [LOINC®](http://www.regenstrief.org/loinc): Logical Observation Identifiers Names and Codes, Regenstrief Institute. Available at: [loinc](http://loinc.org/)
* NHSN members’ website, [NHSN](http://www.cdc.gov/nhsn/).
* [SNOMED CT](http://www.snomed.org/snomedct/index.html)®: SNOMED Clinical Terms SNOMED International Organization. Available at: [snomed-ct](http://www.ihtsdo.org/snomed-ct).
* W3C, *XML Path Language (XPath) Version 1.0* (November 16, 1999, revised September 7 2015). [xpath](http://www.w3.org/TR/xpath/)

1. Acronyms and Abbreviations

ACoS American College of Surgeons

APRV Airway Pressure Release Ventilation

AR Antimicrobial Resistance

ARO Antimicrobial Resistance Option

ASA American Society of Anesthesiologists

AU Antimicrobial Use

AUP Antimicrobial Use, Pharmacy Option (AUP) Summary Report

AUR Antimicrobial Use and Resistance Module

BPU Blood Products Usage

BSI Bloodstream Infection

C-CDA Consolidated CDA

CDA R2 CDA Release 2

CDA Clinical Document Architecture

CDAD C. difficile-associated disease

CDC Centers for Disease Control and Prevention

CDI *C. difficile* infection

CLIP central-line insertion practice

CPT Current Procedural Terminology

DSTU Draft Standard for Trial Use

EHR electronic health record

EOID Evidence of Infection (Dialysis) Report

FOIA Freedom of Information Act

HAI Healthcare Associated Infection

HAR Hemovigilance Adverse Reaction

HI Hemovigilance Incident Report

HITSP Healthcare Information Technology Standards Panel

HL7 Health Level Seven

HP FLU Influenza Vaccination Summary

HV Hemovigilance

ICP infection control professional

ICU intensive care unit

ID identifier

IDM Information Data Model

IG implementation guide

IHTSDO International Health Terminology Standard Development Organisation

ISBT International Society for Blood Transfusion

IV intravenous

LIO Laboratory-identified organism

LOINC Logical Observation Identifiers Names and Codes

LOS Late Onset Sepsis

MDRO Multi-drug-resistant organism

NCEZID National Center for Emerging and Zoonotic Infectious Diseases

NHSN National Healthcare Safety Network

NICU Neonatal Intensive Care Unit

NUCC National Uniform Claim Committee

OID object identifier

OPC Outpatient Procedure Component

PHIN VADS Public Health Information Network Vocabulary Access and Distribution System

PICC/IV peripherally inserted central catheter/intravenous

PNEU Pneumonia Infection Numerator Report

POM Prevention Process and Outcome Measures Monthly Monitoring

RIM Reference Information Model

SCA Specialty Care Area

SNOMED CT Systematized Nomenclature of Medicine, Clinical Terms

SSI Surgical Site Infection

URL Uniform Resource Locator

URN Universal Resource Name

UTI Urinary Tract Infection

VAD Ventricular Assist Device

VAE Ventilator Associated Event

VAT Vascular Access Type

XML Extensible Markup Language

1. High-Level Changes From Previous Releases

This appendix summarizes the main changes in DSTU releases 3 through 9, Normative Release 1, and the two DSTU ballots for Normative Release 2. This IG is the third STU for Normative Release 3.

DSTU Release 3

Release 3 updated the value set in the population summary report to include the Specialty Care Area (SCA) and Neonatal Intensive Care Unit (NICU) Monthly forms.

To accommodate the recording of sub-groups in the NICU Monthly form, the Summary Encounter now allows a participant element specifying the characteristic of the subgroup (e.g., birth weight under 750g).

A single NHSN code system replaced the finer-grained NHSN code systems.

Final values replaced temporary values in the NHSN code system.

Final values were assigned to two temporary value-set OIDs.

An influenza immunization report no longer records the in-facility location and type.

DSTU Release 4

Release 4 introduced the Laboratory-identified Organisms (LIO) report and updated the population summary report to include the Prevention Process and Outcome Measures Monthly Monitoring (POM) form.

To accommodate the grouping of information in the POM monthly form, the Summary Data Observation may now contain subordinate observations.

In population summary reports, in-facility location and code are now recorded as a participant in the Summary Encounter. Previously, this information was recorded in the header.

A population summary report that does not report in-facility identifier and type now records them with nullFlavors.

In several observations, the values for @classCode, @moodCode, and statusCode/@code were made explicit, making the representation of these templates consistent with the approach elsewhere in this guide.

The guide now uses the Templates Database constraints format.

Resolutions from the September 2009 ballot have been incorporated.

In future releases, an appendix referenced by this summary section will document detailed changes to constraints.

DSTU Release 4.1

Release 4.1 made minor updates to the Urinary Tract Infection (UTI) Report. The Urinary Catheter Observation now conditionally requires a (new) History of Object Presence Observation.

DSTU Release 5

Release 5 included a new report type, the Hemovigilance Incident (HI) Report, and extended the population summary report to support reporting hemovigilance incident summary data and blood-product usage data.

In the Population Summary Report template, a code in the header of the report now identifies the data content of the report.

In the Population Summary Report template, the representation of terms was converted from a value set to tables of single-value bindings.

The NHSN Healthcare Service Location value set changed from STATIC to DYNAMIC.

Release 5 also implemented NHSN changes to data requirements in the Central-line Insertion Practices (CLIP), Procedure, and LIO Reports.

DSTU Release 6

Release 6 included a new report type, Hemovigilance Adverse Reaction (HAR) Report, extended the population summary report to support reporting antimicrobial usage and resistance data (AUP) and *C. difficile* days in a POM report, and made minor changes within existing templates.

Finally, beginning with this release, hai\_voc.xls is a new, reader-friendly resource for value-set information, substituting for the Word tables previously provided at the end of this implementation guide.

DSTU Release 7

Release 7 included a new report type, Evidence of Infection (Dialysis) Report (EOID), and updates to the tables of values for the Population Summary Reports template to support summary reporting for maintenance (also known as chronic) hemodialysis patients.

The guide no longer includes the MDRO/CDAD Report or the clinical statements uniquely associated with it. The MDRO Observation, used in the Findings Section, is updated to also report C. difficile infections. The guide no longer includes the Generic Infection Report.

Several value set bindings changed from STATIC to DYNAMIC.

DSTU Release 8

There were no new reports in this release.

A small number of templates were updated to reflect changes in data collected by the CDC.

The population summary reports were recast for ease of use. This did not change the modeling.

The header templates were refactored for ease of use. This did not change the modeling.

Constraints were edited to record only one element per constraint. This did not change the modeling.

DSTU Release 9

This release added no new reports.

Four numerator reports and four denominator reports that have not yet been implemented or are undergoing substantial change were removed from this release of the HAI IG. These reports may be reintroduced in future.

The numerator reports that were removed are:

* + HAI Hemovigilance Adverse Reaction Report (HAR)
  + HAI Hemovigilance Incident Report
  + HAI Immunization Numerator Report
  + HAI Pneumonia Infection Numerator Report (PNEU)

The denominator reports that were removed are:

* Hemovigilance Incidents (HI) Summary Report
* Blood Products Usage (BPU) Summary Report
* Immunization Summary Reports

The top-level templateId was updated. Several templates were new and several had minor revisions.

Normative Release 1

In addition to the report and template changes described below, the format of the guide itself was restructured to align with the current HL7 state-of-the-art guides. The restructuring simplifies navigation and produces a guide that is more familiar to implementers, reviewers, analysts, and any other consumers.

Two new report(s) were added and none were removed:

* + Antimicrobial Resistance Option (ARO) Summary Report
  + HAI AUR Antimicrobial Resistance Option (ARO) Report

Although they are not new to the IG, the following reports now have separate templates and templateIds rather than being described purely in narrative:

* Antimicrobial Use (AUP) Summary Report
* Intensive Care Unit (ICU) Summary Report
* Neonatal Intensive Care Unit (NICU) Summary Report
* Prevention Process and Outcome Measures (POM) Summary Report
* Specialty Care Area (SCA) Summary Report
* Vascular Access Type Report (VAT) Summary Report

No templates were removed in this release.

Where possible, the HAI templates now conform to Consolidated CDA (C-CDA) templates, which is a requirement of Meaningful Use 2. C-CDA templates represent a significant effort by industry stakeholders; they are the best available standard to require for certification and to meet policy objectives for interoperability.

Summary reports were moved from purely narrative descriptions into report-specific templates.

Most narrative constraints were converted to computable constraints.

Normative Release 2, 1st DSTU

No reports were added or removed. Four new entry-level templates were added

* Infection Present at the Time of Surgery Observation
* SSI Detected Using Toolkit Observation
* Revision Associated with Prior Infection Observation
* Loss of Vascular Access Observation

No new value sets were added, but some codes were added or removed:

* A code for “Number of APRV days” (1834-1) from codeSystem cdcNHSN (2.16.840.1.113883.6.277), was added to the Intensive Care Unit (ICU) Summary Report and the Neonatal Intensive Care Unit (NICU) Summary Report.
* A code “Number of central line days” (1833-3) from codeSystem cdcNHSN (2.16.840.1.113883.6.277) was deprecated from the Neonatal Intensive Care Unit (NICU) Summary Data table.
* A code "Number of central line days including umbilical catheter" (1854-9) from codeSystem cdcNHSN (2.16.840.1.113883.6.277) was added to the Neonatal Intensive Care Unit (NICU) Summary Data table.
* A code for “Urinary Tract Infection” (68566005) from codeSystem SNOMED CT (2.16.840.1.113883.6.96), was added to the Infection Type Value Set for the Criterion of Diagnosis Observation.

Normative Release 2, Update to 1st DSTU

There were no normative changes in this update.

The guide was divided into two volumes. Volume 1 contains an overview of Clinical Document Architecture (CDA) markup standards, design, and use. Volume 2 contains the library of CDA templates for electronic submission of HAI Reports to NHSN-CDC.

Three codes were added to and two codes were deprecated from the Criterion of Diagnosis value set.

Normative Release 2, 2nd DSTU

Two new reports, each containing new templates, were added:

* HAI Outpatient Procedure Component (OPC) Event Report, 2.16.840.1.113883.10.20.5.47
* Findings Section in an OPC Report, 2.16.840.1.113883.10.20.5.5.55
* Other Event Details Section, 2.16.840.1.113883.10.20.5.5.54
* Prophylactic IV Antibiotic Timing Observation, 2.16.840.1.113883.10.20.5.6.209
* Same Day Outcome Measures Organizer, 2.16.840.1.113883.10.20.5.6.212
* Same Day Outcome Measure Observation, 2.16.840.1.113883.10.20.5.6.208
* Surgical Site Infection Details Section in an OPC Report, 2.16.840.1.113883.10.20.5.5.53
* Infection First Reported Source Observation, 2.16.840.1.113883.10.20.5.6.207
* Procedure Details in an OPC Report, 2.16.840.1.113883.10.20.5.6.211
* Surgical Site Infection Observation, 2.16.840.1.113883.10.20.5.6.210
* HAI Outpatient Procedure Component (OPC) Summary Report, 2.16.840.1.113883.10.20.5.48
* Summary Data Section (OPC), 2.16.840.1.113883.10.20.5.5.56
* Summary Encounter (OPC), 2.16.840.1.113883.10.20.5.6.213
* Summary Data Observation (OPC), 2.16.840.1.113883.10.20.5.6.214
* Procedure Category, 2.16.840.1.113883.10.20.5.6.215

Normative Release 2, Update to 2nd DSTU

No reports were added or removed. Five reports were revised:

* HAI AUR Antimicrobial Resistance Option (ARO) Report
* HAI Central-Line Insertion Practice Numerator Report
* HAI Evidence of Infection (Dialysis) Report
* HAI Laboratory-Identified Organism (LIO) Report
* Prevention Process and Outcome Measures (POM) Summary Report

Eleven new templates were added:

* Antimicrobial Coated Catheter Used Observation
* Bacterial Isolate Tested for Carbapenemase Observation
* Blood Collection Location
* Carbapenemase Test Observation
* Carbapenemase Test Organizer
* Carbapenemase Type Identified Observation
* Contraindication Type Observation
* Last Physical Overnight Location
* Other Facility Discharge Encounter
* Positive Test for Carbapenemase Observation
* Primary C. Difficile Testing Method This Quarter

Three new value sets were added:

* NHSNArDrugSuscTestsCode (2.16.840.1.114222.4.11.7230)
* NullValues\_UNK\_OTH (2.16.840.1.113883.10.20.5.9.1)
* NullValues\_UNK\_NA (2.16.840.1.113883.10.20.5.9.2)
* NHSNLastLocationEncounterTypeCode (2.16.840.1.113883.10.20.5.9.2)

One new code was added for use in the Summary Encounter in the Intensive Care Unit (ICU) Summary Report and the Specialty Care Area (SCA) Summary Report:

* New Episodes of Mechanical Ventilation

Normative Release 2, First Normative Ballot

Three reports were revised:

* HAI AUR Antimicrobial Resistance Option (ARO) Report (V3)
* Antimicrobial Resistance Option (ARO) Summary Report (V2)
* Antimicrobial Use (AUP) Summary Report (V2)

One new template was added; this template is a refactoring of the generic Summary Data Observation that pulls out the AU/AR data into a separate template:

* Summary Data Observation (AU/AR)

Where necessary, templates above the new templates in the hierarchy have been versioned.

A third stand-alone volume was added. It consolidates copies of the antimicrobial use and resistance templates for single-person and summary reports; those templates also remain in Volume 2.

Normative Release 3, 1st DSTU

One report was added:

* Hemovigilance (HV) Summary Report

Two reports were revised:

* HAI Evidence of Infection (Dialysis) Report (V4)
* Vascular Access Type Report (VAT) Summary Report (V2)

Ten new templates were added:

* Summary Data Section (HV)
* Blood Product Usage Summary Observation
* Dialyzer Reused Observation
* Facility Transfuses Pathogen Reduced/Inactivated Blood Products Observation
* ISBT Product Code Summary Observation
* No Adverse Reactions Reported This Month Observation
* No Incidents Reported This Month Observation
* Summary Data Observation (HV)
* Summary Encounter (HV)
* Type of Antimicrobial Start Observation

Four templates were revised:

* Infection Indicator Organizer (V3)
* IV Antibiotic Start Clinical Statement (V2)
* Details Section in an Evidence of Infection (Dialysis) Report (V4)
* Risk Factors Section in an Evidence of Infection (Dialysis) Report (V2)

Thirty new value sets were added:

* NHSN Start or Continuation
* NHSN Summary Blood Product Usage
* NHSN Whole Blood Total
* NHSN Red Blood Cells/Whole Blood Derived/Not Irradiated or Leukocyte Reduced
* NHSN Red Blood Cells/Whole Blood Derived/Irradiated
* NHSN Red Blood Cells/Whole Blood Derived/Leukocyte Reduced
* NHSN Red Blood Cells/Whole Blood Derived/Irradiated And Leukocyte Reduced
* NHSN Red Blood Cells/Apheresis/Not Irradiated or Leukocyte Reduced
* NHSN Red Blood Cells/Apheresis/Irradiated
* NHSN Red Blood Cells/Apheresis/Leukocyte Reduced
* NHSN Red Blood Cells/Apheresis/Irradiated or Leukocyte Reduced
* NHSN Platelets/Whole Blood Derived/Not Irradiated or Leukocyte Reduced
* NHSN Platelets/Whole Blood Derived/Irradiated
* NHSN Platelets/Whole Blood Derived/Leukocyte Reduced
* NHSN Platelets/Whole Blood Derived/Irradiated And Leukocyte Reduced
* NHSN Platelets/Apheresis/Not Irradiated or Leukocyte Reduced
* NHSN Platelets/Apheresis/Irradiated
* NHSN Platelets/Apheresis/Leukocyte Reduced
* NHSN Platelets/Apheresis/Irradiated or Leukocyte Reduced
* NHSN Plasma/Whole Blood Derived/Total
* NHSN Plasma/Apheresis/Total
* NHSN Cryoprecipitate
* NHSN Platelets/Whole Blood Derived/Psoralen-Treated
* NHSN Platelets/Whole Blood Derived/Riboflavin-Treated
* NHSN Platelets/Apheresis/Psoralen-Treated
* NHSN Platelets/Apheresis/Riboflavin-Treated
* NHSN Plasma/Whole Blood Derived/Psoralen-Treated
* NHSN Plasma/Whole Blood Derived/Riboflavin-Treated
* NHSN Plasma/Apheresis/Psoralen-Treated
* NHSN Plasma/Apheresis/Riboflavin-Treated

One new code was added to the value set Codes for Vascular Access Type (Dialysis) Summary Data.

A fourth stand-alone volume was added. It consolidates copies of the hemovigilance templates summary report; those templates also remain in Volume 2.

Normative Release 3, Update to 1st DSTU

Three reports were revised:

* HAI Evidence of Infection (Dialysis) Report (V5)
* Hemovigilance (HV) Summary Report (V2)
* HAI AUR Antimicrobial Resistance Option (ARO) Report (V4)

Two new templates were added:

* Blood Sample Collected for Culture Observation
* Pathogen Reduced Apheresis Platelet Usage Summary Observation

Fourteen templates were revised:

* Antimicrobial Susceptibility Result Observation (V3)
* Antimicrobial Susceptibility Result Organizer (V3)
* Antimicrobial Susceptibility Tests Organizer (V3)
* Blood Product Usage Summary Observation (V2)
* Facility Transfuses Blood Products Treated with Pathogen Reduction Technology Observation (V2)
* Infection Indicator Organizer (V4)
* ISBT Product Code Summary Observation (V2)
* Isolate Susceptibility Tests Organizer (V3)
* IV Antibiotic Start Clinical Statement (V3)
* Specimen Collection Procedure (ARO) (V3)
* Summary Encounter (HV) (V2)
* Details Section in an Evidence of Infection (Dialysis) Report (V5)
* Findings Section in an ARO Report (V3)
* Summary Data Section (HV) (V2)

Twelve new value sets were added:

* NHSN Red Blood Cells/Whole Blood Derived/S-303-Treated
* NHSN Red Blood Cells/Whole Blood Derived/Riboflavin-Treated
* NHSN Red Blood Cells/Apheresis/S-303-Treated
* NHSN Red Blood Cells/Apheresis/Riboflavin-Treated
* NHSN Cryoprecipitate/Psoralen-Treated
* NHSN Cryoprecipitate/Riboflavin-Treated
* NHSN Platelets/Apheresis/Psoralen-Treated and In Plasma
* NHSN Platelets/Apheresis/Psoralen-Treated and In Platelet Additive Solution
* NHSN Platelets/Apheresis/Riboflavin-Treated and In Plasma
* NHSN Platelets/Apheresis/Riboflavin-Treated and In Platelet Additive Solution
* NHSNPathogenReducedApheresisPlateletUsage
* NHSNDrugSusceptibilityTestMethod

Six value sets were revised:

* NHSNHealthcareServiceLocationCode
* NHSNPathogenCode
* NHSNSpecimenTypeCode
* NHSNDrugSusceptibilityTestsCode
* NHSNCdiffTestMethod
* NHSNCriterionOfDiagnosisCode

Normative Release 3, 2nd STU

Two reports were added:

* Ventilator Associated Event (VAE) Report
* Healthcare Personnel Influenza Vaccination (HP FLU) Summary Report

One report was revised:

* HAI Bloodstream Infection Report (BSI) (V2)

Twelve new templates were added:

* Summary Data Section (HP-FLU)
* Infection Details Section in a VAE Report
* Risk Factors Section in a VAE Report
* NHSN Comment Section
* Summary Encounter (HP-FLU)
* Vaccination Type Observation
* NHSN Comment
* Hemodialysis Catheter Present
* Extracorporeal Life Support Present
* Ventricular Assist Device (VAD) Present
* Mechanical Ventilation Initiation Act
* APRV or Related at Time of VAE Observation

One template was revised:

* Infection Risk Factors Section in a BSI Report (V2)

Two new value sets were added:

* NHSNHealthcarePersonnelType
* NHSNInfluenzaVaccinationSetting

Four value sets were revised:

* NHSNCriterionOfDiagnosis
* NHSNInfectionConditionCode
* NHSNInfectionTypeCode
* NHSNPopulationSummaryReportTypeCode

Normative Release 3, 3rd STU

One new report:

* Late Onset Sepsis/Meningitis Event (LOS) Report

Two removed (i.e., retired) reports:

* HAI Outpatient Procedure Component (OPC) Event Report
* HAI Outpatient Procedure Component (OPC) Summary Report

Six revised reports:

* Intensive Care Unit (ICU) Summary Report (V3)
* Neonatal Intensive Care Unit (NICU) Summary Report (V3)
* Prevention Process and Outcome Measures (POM) Summary Report (V3)
* Specialty Care Area (SCA) Summary Report (V3)
* Vascular Access Type Report (VAT) Summary Report (V3)
* HAI Bloodstream Infection Report (BSI) (V3)

Eleven new templates:

* Infection Details in Late Onset Sepsis Report
* Report No Events Section
* Risk Factors Section (LOS/Men)
* Epidermolysis Bullosa Observation
* Gestational Age Observation
* Group B Streptococcus in First 6 Days of Life Observation
* Inborn/Outborn Observation
* Known or Suspected Munchhausen’s by Proxy Observation
* Observed or Suspected Patient Injection into Vascular Line Observation
* Pus Present in Site and Matching Organism in Blood and Specimen Observation
* Report No Events Observation

Two revised templates:

* Infection Risk Factors Section in a BSI Report (V3)
* Summary Data Section (NICU) (V2)

Twelve removed (i.e., retired) templates:

* Infection First Reported Source Observation
* Procedure Category
* Prophylactic IV Antibiotic Timing Observation
* Same Day Outcome Measure Observation
* Same Day Outcome Measures Organizer
* Summary Data Observation (OPC)
* Summary Encounter (OPC)
* Surgical Site Infection Observation
* Findings Section in an OPC Report
* Other Event Details Section
* Summary Data Section (OPC)
* Surgical Site Infection Details Section in an OPC Report

Eight new value sets:

* NHSNInbornOutbornObservationCode
* NHSNLOS/MENEvent
* NHSNReportNoEventsICU
* NHSNReportNoEventsNICU
* NHSNReportNoEventsSCA
* NHSNReportNoEventsMDRO
* NHSNReportNoEventsDialysis
* NHSNVascularSpecimenCollectionSite

Seven revised value sets:

* NHSNCriterionofDiagnosis
* NHSNHealthcareServiceLocations
* NHSNInfectionCondition
* NHSNInfectionType
* NHSNPathogenCode
* NHSNPopulationSummaryReportType
* NHSNVascularAccessType

1. Document and Section Codes (Non-normative)

The templates in Volumes 2, 3, and 4 use LOINC codes to identify the document type and section types. The document and section templates specify which code to use. This appendix is provided as a convenient summary for the implementer.

Table 3: Document and Section Codes

| codeSystem | Name | code | Meaning |
| --- | --- | --- | --- |
| 2.16.840.1.113883.6.1 | LOINC | 51897-7 | Healthcare Associated Infection Report |
| 51898-5 | Risk Factors Section |
| 51899-3 | Details Section |
| 18769-0 | Findings Section |
| 51900-9 | Summary Data Section |
| 46240-8 | History of Encounters |

1. Consolidated CDA (C-CDA) Templates Referenced in This Guide

A few NHSN templates conform to templates in the C-CDA guide: *HL7 Implementation Guide for CDA Release 2.0, Consolidated CDA Templates, R1.1 (US Realm).*[[6]](#footnote-7)

Table 4: C-CDA Template OIDs

| Template Title | Template OID |
| --- | --- |
| Deceased Observation | 2.16.840.1.113883.10.20.22.4.79 |
| Encounter Activities | 2.16.840.1.113883.10.20.22.4.49 |
| Indication | 2.16.840.1.113883.10.20.22.4.19 |
| Medication Activity | 2.16.840.1.113883.10.20.22.4.16 |
| Problem Observation | 2.16.840.1.113883.10.20.22.4.4 |
| Procedure Activity Act | 2.16.840.1.113883.10.20.22.4.12 |
| Procedure Activity Observation | 2.16.840.1.113883.10.20.22.4.13 |
| Procedure Activity Procedure | 2.16.840.1.113883.10.20.22.4.14 |
| Result Observation | 2.16.840.1.113883.10.20.22.4.2 |
| Result Organizer | 2.16.840.1.113883.10.20.22.4.1 |
| Vital Sign Observation | 2.16.840.1.113883.10.20.22.4.27 |

1. Example Instance Identifiers (Non-normative)

As discussed in [Background](#IG_S_Background) and [Example Instance Identifiers](#IG_S_Example_Instance_Identifiers), much of the development of this guide was driven by a pilot project in July 2007. The pilot project assigned example OIDs to a fictional facility and vendor to illustrate the numbering schemes for which facilities and vendors are responsible. In practice, these identifiers will be assigned by facilities and software applications within those facilities participating in the NHSN.

All example OIDs in this IG and in the accompanying sample files begin with 2.16.840.1.113883.3.117.1.1.5. and are documented below for reference.

Each OID-owner such as a facility or vendor controls the structure of the OIDs it assigns under its root, and is responsible for ensuring that each identifier it issues is globally unique. A vendor must, for example, ensure that there is no duplication amongst the setIds issued by its various software installations. The example instance identifiers in this guide use the following plan for assigning instance identifiers:

Table 5: Structure of Example OIDs

|  |  |
| --- | --- |
| Usage | OID |
| a healthcare facility OID | 2.16.840.1.113883.3.117.1.1.5.1.1 |
| its patient IDs | 2.16.840.1.113883.3.117.1.1.5.1.1.1 |
| its personnel IDs | 2.16.840.1.113883.3.117.1.1.5.1.1.2 |
| a vendor OID | 2.16.840.1.113883.3.117.1.1.5.2.1 |
| its first software installation | 2.16.840.1.113883.3.117.1.1.5.2.1.1 |
| its setIds | 2.16.840.1.113883.3.117.1.1.5.2.1.1.1 |
| its document IDs | 2.16.840.1.113883.3.117.1.1.5.2.1.1.2 |
| its encounter IDs | 2.16.840.1.113883.3.117.1.1.5.2.1.1.3 |
| its procedure IDs | 2.16.840.1.113883.3.117.1.1.5.2.1.1.4 |
| its event / incident IDs | 2.16.840.1.113883.3.117.1.1.5.2.1.1.5 |
| etc. |  |

Conformant to that structure, the following example instance identifiers may be used in this guide and in the sample files.

Table 6: Values of Example Instance Identifiers Used in This Guide

|  |  |  |
| --- | --- | --- |
| Facility IDs and Facility-assigned OIDs | | |
| Usage | OID | extension |
| a location in a facility | 2.16.840.1.113883.3.117.1.1.5.1.1 | 9W |
| a patient ID | 2.16.840.1.113883.3.117.1.1.5.1.1.1 | 123456 |
| facility personnel: |  |  |
| author ID | 2.16.840.1.113883.3.117.1.1.5.1.1.2 | anAuthorID |
| legal authenticator ID | 2.16.840.1.113883.3.117.1.1.5.1.1.2 | aLegalAuthenticatorID |
| performer (nurse) | 2.16.840.1.113883.3.117.1.1.5.1.1.2 | 24242424 |
| Vendor-software-assigned OIDs | | |
| Usage | OID | extension |
| software ID | 2.16.840.1.113883.3.117.1.1.5.2.1.1 | aSoftwareID |
| setId | 2.16.840.1.113883.3.117.1.1.5.2.1.1.1 | 31 |
| document ID | 2.16.840.1.113883.3.117.1.1.5.2.1.1.2 | 20202201 93 |
| encounter ID | 2.16.840.1.113883.3.117.1.1.5.2.1.1.3 | 31 |
| procedure ID | 2.16.840.1.113883.3.117.1.1.5.2.1.1.4 | 92 |
| event / incident ID | 2.16.840.1.113883.3.117.1.1.5.2.1.1.5 | 21987654321 11987654321 |

1. Vocabulary Heuristics for Codes and Value Sets (Non-normative)

The CDC has identified questions and allowable responses for HAI form fields. In many cases these questions and responses have been mapped to local CDC/NHSN codes, and it is the CDC's intention to identify corresponding standard codes. Within the CDC, different groups have done vocabulary mapping work (e.g., with HL7 V2 messages), often with different results, and efforts are underway to not only reconcile internal CDC vocabulary usage, but also reconcile CDC vocabulary usage with the Healthcare Information Standards Technology Panel (HITSP) recommendations.

Vocabularies recommended in this guide are primarily standard vocabularies recommended for use in particular domains. In many cases these vocabularies are further constrained into value sets for use within this guide or were previously constrained into value sets by the CDC.

The incremental strategy for vocabulary reconciliation for codes, code systems, and value sets in this document is as follows.

Code and codeSystem Selection

* Where there is conflicting precedent within the CDC, CDC will advise on the preferred CDC code system.
* Where there is a preferred code system within the CDC that is consistent with HITSP recommendations, existing CDC-cited code systems are used.
* Where there is a preferred code system within the CDC that is not consistent with HITSP recommendations, divergence from HITSP is flagged, and reconciliation between CDC and HITSP is planned (but outside the scope of this document).
* Where there is no established precedent within the CDC, available HITSP recommendations will be followed.
* Where there is no established precedent within the CDC and no HITSP recommendations, precedent in prior CDA Implementation Guides will be followed.
* Where there is no established precedent within the CDC, no HITSP recommendations, and no prior CDA IG precedent:
  + An attempt will be made to map CDC/NHSN local codes to standard codes (e.g., SNOMED, HL7 V3 vocabularies).
  + Where there is no corresponding standard code, the CDC/NHSN local code will be cited. (Submitting local CDC/NHSN codes to SNOMED is outside the scope of this document.)
* If post-coordination of SNOMED terms and codes would be required to capture the CDC/NHSN concept, the local CDC/NHSN code will be used.

Value Set Assignment and Maintenance

* Where there is conflicting precedent within the CDC, CDC will advise on the preferred CDC value set.
* Where there is a preferred CDC value set that is consistent with HITSP recommendations, existing CDC value sets are used.
* Where there is a preferred CDC value set that is not consistent with HITSP recommendations, divergence from HITSP is flagged, and reconciliation between CDC and HITSP is planned (but outside the scope of this document).
* Where there is no established precedent within the CDC, available HITSP recommendations will be followed.
* Where there is no established precedent within the CDC and no HITSP recommendations, then precedent in prior CDA Implementation Guides will be followed.
* Where there is no established precedent within the CDC, no HITSP recommendations, and no prior CDA IG precedent, new value sets will be created, each having a value set OID assigned by the CDC.

1. HL7 CDA R2. [HL7](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=7) [↑](#footnote-ref-2)
2. *HL7 V3: Refinement, Constraint and Localization.* [HL7](http://www.hl7.org/v3ballot/html/infrastructure/conformance/conformance.htm) [↑](#footnote-ref-3)
3. *HL7 Version 3 Publishing Facilitator's Guide.* [HL7](http://www.hl7.org/v3ballot/html/help/pfg/pfg.htm) [↑](#footnote-ref-4)
4. *HL7 Version 3 Interoperability Standards.* [http://www.hl7.org/memonly/downloads/v3edition.cfm - V32010](http://www.hl7.org/memonly/downloads/v3edition.cfm#V32010) [↑](#footnote-ref-5)
5. W3C, *XML Path Language.* [Xpath](http://www.w3.org/TR/xpath/) [↑](#footnote-ref-6)
6. HL7, *Consolidated CDA.* [hl7](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=258) [↑](#footnote-ref-7)