

Health Information Technology Standards
Series Editor: Tim Benson

Tim Benson
Grahame Grieve

Principles of Health Interoperability

SNOMED CT, HL7 and FHIR

Third Edition

 Springer

Health Information Technology Standards

Series Editor

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Health information technology is one of the fastest growing industry sectors. The purpose of this book series is to provide monographs covering the rationale, content and use of these and other standards to help bridge the gap between the need for and availability of qualified and knowledgeable staff. This series will be focused on health informatics technology standards and the technology driving change in health IT. It will appeal to the traditional informatics market, but also cross over into more technical disciplines, but without leaving the remit that this is to expand knowledge in healthcare IT. It will comprise a set of single-author, practically focused, academically driven concise reference monographs on the leading standards and their application. Each volume will focus on one or more specific standards and explain how to use each one individually or in combination. This provides a tight focus for each book. The aim is to offer a set of “must have” references on the widely used standards, and in particular those mandated by the ONC.

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*Tim Benson dedicates this book to his sons
Laurence, Oliver, Alex and Jamie.*

*Grahame Grieve dedicates this book to his
family, who lit the fire in the first place.*

Foreword to the Third Edition

Recent US Government reports have included statements such as:

The apparent inability of the private sector to achieve interoperable systems suggests the need for national leadership to support their creation.

Information blocking occurs when persons or entities knowingly and unreasonably interfere with the exchange or use of electronic health information.

Health lacks a common language to share data.

Each of these points oversimplifies the real issues facing healthcare information exchange. A combination of technology, policy and alignment of incentives has worked in every industry to enable data liquidity. If stakeholders understand all the issues, the same thing will happen in healthcare.

Unfortunately, domain expertise in interoperability is rare. The standards are esoteric and detailed. Politics and emotion can cloud the objective evaluation of standards that are suitable for purpose, well documented and mature enough for adoption.

Principles of Health Interoperability: SNOMED CT, HL7 and FHIR (3rd edition) by Tim Benson and Grahame Grieve provides an accessible, well-organized primer that is objective and clear. It clarifies that interoperability is not just as simple as pushing HL7 transactions from point to point.

When I was 2 years old in 1964, my mother gave me ampicillin and I developed two red dots on my stomach. She declared me allergic to penicillin. For 50 years my medical record has said “penicillin allergy” and not:

Substance: Pencillins and Cephalosporins

Reaction: Urticaria

Observer: Mother

Level of Certainty: Very Uncertain

Date of observation: January 1, 1964

If we are to share data among stakeholders, we need easy to implement technologies that provide a structure for the information (such as the five components of an

allergy above), appropriate vocabularies (how do we describe the nature of the reaction in a uniform fashion) and a secure means of transmitting that information over the wire. If I was diagnosed with a live threatening strep infection, for which Penicillin is the most effective drug, would a clinician make a different decision on treatment knowing that my allergy is uncertain and minor? Certainly.

Principles of Health Interoperability is a must read for policymakers, technology leaders and industry implementers. The book distills thousands of pages of standards into the essential information you need to know. The addition of the *Fast Healthcare Interoperability Resources* (FHIR) makes the 3rd edition even better than the 2nd edition. FHIR will enable an ecosystem of apps, which layer on top of existing EHRs, reduce the cost of interfacing and accelerate innovation.

If you are looking for the definitive resources on the latest techniques to implement content, transport and vocabulary interoperability, look no further than this book. It will be a centerpiece of my own bookshelf.

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John D. Halamka

Foreword to the First Edition

Health data standards are a necessary component of interoperability in healthcare. Aggregation of health-related data mandates the use of standards, and aggregation is necessary to support safe and quality care. The American Recovery and Reinvestment Act (ARRA) includes \$19 billion dollars in direct funding and an additional \$18.5 billion in returned savings tagged to the use of health information technology (HIT). The resulting expanding use of HIT has engaged a growing number of stakeholders, many of whom now realize the value of standards.

All aspects of creating and “meaningful use” of electronic health records (EHRs) require standards. With the increasing demand for individuals knowledgeable in what standards are available and how and when to use those standards, this book is most welcome. The author, Tim Benson, has been engaged in the creation of standards since the beginning. His experiences span organizations – including HL7, CEN and ISO and terminologies such as SNOMED and LOINC. He has engaged the global community and understands similarities as well as differences among the global community. He has a top reputation as a teacher and writer within the international community. I know no other individual more qualified to write this book than Tim Benson.

In *Principles of Health Interoperability HL7 and SNOMED*, Tim focuses on major contributors to the set of required standards. In the first section, he lays out a framework for why interoperability is important and what is needed to accomplish that interoperability. Health Level Seven (HL7) is pre-eminent among the several contributing Standards Developing Organizations (SDOs) in the global community. HL7 standards are widely used and cover the full spectrum of applications. Its membership is international (currently including over 35 countries) and includes the major HIT vendors and representatives of the full set of stakeholders. The International Healthcare Technology Standards Developing Organization (IHTSDO) is rapidly promoting SNOMED CT as the preferred terminology in healthcare. While focusing on HL7 and SNOMED CT, Tim has included much useful information on other standards and other organizations.

Readers will find this book easy to read, even if it is their first exposure to standards. In this rapidly changing field, this book is a must for anyone who is involved or has interest in the use of health information technology – and who isn't.

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W. Ed Hammond

Foreword to the Second Edition

The success of this book validates the above remarks. Interoperability and the focus of the broad community on this topic and the implementation of systems and standards that support interoperability have grown at an exponential rate. As the implementation of Health Information Interchange systems grows, more and more people join the workforce to support this growth. They need to be taught and learn about standards supporting interoperability. A number of colleagues and I use this book as a text. The students love it – it is clear and easy to read and understand. Technology and the ensuing standards to support standards change rapidly. In this second addition, Tim has astutely addressed this challenge. In some sections, he expanded the material; in others, he reorganized the material; and, most importantly, he added new sections to increase the comprehension and coverage of the topic. The second edition is even better than the first.

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Preface

Interoperability is one of the hottest topics in healthcare, yet one of the least well understood. Successful interoperability offers great opportunities to improve quality and outcomes while reducing waste and costs. The task of interoperability is to deliver the right information at the right time to the right place. Everybody (patient, clinician, manager and payer) stands to benefit from more soundly based decisions, safer care and less waste, errors, delays and duplication.

Interoperability needs appropriate standards to link computer systems, and to share information in a way that meets security and privacy needs. SNOMED CT and HL7 (including FHIR) provide key standards that underpin efforts to improve healthcare interoperability. HL7 provides the structure, rather like English grammar, while SNOMED CT provides the words that computers understand.

This book gives a broad introduction to healthcare interoperability in general, and the main standards, setting out the core principles in a clear readable way for analysts, students and clinicians.

The third edition of this book is fully revised, reorganized and extended. There are five new chapters on FHIR (Fast Healthcare Interoperability Resources), written by Grahame Grieve, the father of FHIR. This is the first comprehensive introduction to FHIR in any book.

FHIR APIs are likely to have a massive disruptive impact on healthcare interoperability, being an order of magnitude less expensive to implement than previous standards. FHIR will also support an explosion of patient-centric apps that can interoperate with legacy systems.

To accommodate these changes, we have changed the order of the chapters, so that clinical terminology and SNOMED CT come before HL7 interchange formats, v2, v3, CDA and FHIR. The introductory chapters have also been revised and updated.

The book is organized in four parts. The first part covers the principles of health-care interoperability, why it matters, why it is hard and why modeling is an important part of the solution. The second part covers clinical terminology and SNOMED CT. The third part covers the longer established HL7 standards, v2, v3, CDA and IHE XDS. The final part covers FHIR.

Newbury, UK
Melbourne, Australia
January 2016

Tim Benson
Grahame Grieve

Principles of Health Interoperability: SNOMED CT, HL7 and FHIR (3rd Edition)

Healthcare interoperability delivers information when and where it is needed. Everybody stands to gain from safer more soundly based decisions and less duplication, delays, waste and errors. This book provides an introduction to healthcare interoperability and the main standards used.

The third edition includes a new part on FHIR (Fast Healthcare Interoperability Resources), the most important new health interoperability standard for a generation. FHIR combines the best features of HL7's v2, v3 and CDA, while leveraging the latest web standards and a tight focus on implementation. FHIR can be implemented at a fraction of the price of existing alternatives and is well suited for mobile phone apps, cloud communications and EHRs.

The book is organized into four parts. The first part covers the principles of health interoperability, why it matters, why it is hard and why models are an important part of the solution. The second part covers clinical terminology and SNOMED CT. The third part covers the main HL7 standards: v2, v3, CDA and IHE XDS. The new fourth part covers FHIR and has been contributed by Grahame Grieve, the original FHIR chief.

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Grahame Grieve: FHIR is a community, a collective accomplishment, and many people have contributed, too many to list. But a few deserve mention: Ewout Kramer, Lloyd McKenzie, Josh Mandel, James Agnew, Brian Postlethwaite and David Hay for contributing the most to the community and the specification. More personally, Kevin Moynihan, David Rowlands, Thomas Beale, Kim Clohessy, Chuck Jaffe, Gunther Schadow, Charlie McCay, Andy Bond and Woody Beeler have contributed enormously to my understanding of healthcare, integration and the business environment in which it thrives. Also thanks to Mel Grieve for editing the FHIR part, and to my family for sharing their holidays with this book.

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Contents

Part I Principles of Health Interoperability

1	The Health Information Revolution	3
	Healthcare is Communication.....	3
	Information Handling.....	6
	Gutenberg.....	6
	Use of Information.....	7
	Clinical Decisions	9
	Lessons from History.....	10
	El Camino Hospital.....	10
	Success in GP Surgeries.....	11
	Failure in Hospitals	12
	NHS National Programme of IT	13
	Canada.....	14
	Denmark.....	14
	Meaningful Use.....	15
	References.....	16
2	Why Interoperability Is Hard	19
	Layers of Interoperability	19
	Definitions.....	20
	Technical Interoperability	20
	Semantic Interoperability	21
	Process Interoperability.....	21
	Clinical Interoperability	22
	Why Standards Are Needed.....	23
	Combinatorial Explosion	23
	Translations	24
	Electronic Health Records	24
	Problem-Oriented Medical Records.....	25