SNOMED CT
The case for investment

SNOMED CT
The global language of healthcare

September 2021
The Case for Investment in SNOMED CT
CASE FOR INVESTMENT

Our Approach

The Case for Investment in SNOMED CT has been developed using:

- The SNOMED CT value framework and its focus on how SNOMED CT-embedded clinical information systems, health data & analytics platforms and interoperability solutions can contribute to improving patient service outcomes (i.e. access and productivity) and patient health outcomes (i.e. patient safety, morbidity and mortality).

- The domains where SNOMED CT is used (e.g. data entry/integration, information sharing, analytics and research).

- A combination of ten case studies, a benefits model, an economic analysis, and the case for investment in SNOMED CT.

- Both quantitative and qualitative analysis.
The Symbiotic Relationship

- SNOMED CT must be embedded in a clinical information system, health data & analytics platform or an interoperability solution for it to function.
- Conversely, clinical information systems, health data & analytics platforms and interoperability solutions must use clinical terminologies like SNOMED CT to operate effectively.

Patient Outcome Benefits

- SNOMED CT is only one of many contributing factors to improving patient outcomes.
- There are no studies that demonstrate improved patient outcomes benefits directly attributable to SNOMED CT.
- However, studies do show that the use of SNOMED CT-embedded systems do provide significant qualitative and quantitative patient outcome benefits.

Benefits Measurement

- Patient outcome benefits are described as patient service outcomes (e.g. improvements in access and productivity) and patient health outcomes (e.g. improvements in patient safety, morbidity and mortality).
- Benefits are measured in both financial terms (e.g. dollars saved) and non-financial terms (e.g. bed days reduced, deaths avoided).
- The case studies and quantitative models provide directional estimates of select benefits enabled (in part) by SNOMED CT.
SNOMED CT
Case for Investment

The Case for Investment identifies why a country would invest resources to implement SNOMED CT.

1. What value does a country or healthcare entity desire from a clinical terminology?

2. What potential value does SNOMED CT provide to a specific country or a healthcare entity?

3. What demonstrated value has SNOMED CT provided to a country or a healthcare entity in the past?

4. What are the future opportunities for SNOMED CT?

5. Why would a country or a healthcare entity invest resources to implement SNOMED CT?
SNOMED CT
Case for Investment

Q1. What Value Does a Country Desire From a Clinical Terminology?

“SNOMED CT is the best available core reference terminology for cross-border, national and regional eHealth deployments in Europe”

ASSESS CT 2016
Q1. What Value Does a Country Desire From a Clinical Terminology?

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Benefits Measurement

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- Benefits are measured in both financial terms (e.g. dollars saved) and non-financial terms (e.g. bed days reduced, deaths avoided).
- The case studies and quantitative models provide directional estimates of select benefits enabled (in part) by SNOMED CT.
When a country or healthcare entity evaluates a clinical terminology they do it from two perspectives:

- the value of the terminology itself, and
- the on-going management of the terminology.

To assess the value of the SNOMED CT to a country we considered frameworks from three separate studies:

1. The desired features of a controlled terminology (vocabulary) as outlined by Cimino\(^1\). The presence of these features in a controlled vocabulary (terminology) demonstrate whether the terminology is fit-for-purpose, or not.

2. The data quality management criteria used by the American Health Information Management Association to critique the similarities and differences between SNOMED CT and ICD-10\(^2\).

3. The criteria developed by ASSESS CT through research, interviews and focus groups to evaluate the suitability of SNOMED CT for large scale e-health deployments within the E.U\(^3\).
1. **SNOMED CT meets all the Cimino criteria that determine whether a terminology is fit-for-purpose.**

<table>
<thead>
<tr>
<th>Terminology Criteria</th>
<th>Description</th>
<th>SNOMED CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Content</td>
<td>Does the terminology have comprehensive content?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>2. Concept Orientation</td>
<td>Do the terms correspond to at least one meaning (nonvagueness) and no more than one meaning (non-ambiguity), and that meanings correspond to no more than one term (non-redundancy)?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>3. Concept Permanence</td>
<td>Is the meaning of a concept, once created, inviolate (does not change)?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>4. Non-Semantic Concept Identifier</td>
<td>Do the concepts have a unique identifier, without any meaning built into the identifier?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>5. Poly-Hierarchy</td>
<td>Is the terminology organized into multiple hierarchies?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>6. Formal Definitions</td>
<td>Does the terminology have formal definitions, including the expression of relationships among concepts that can be manipulated with a computer?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>7. Reject “Not Classified Elsewhere”</td>
<td>Does the terminology NOT include catch-all terms (e.g. not classified elsewhere) which can be used to encode information that is not represented by other existing terms.</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>8. Multiple Granularities</td>
<td>Does the terminology allow multiple granularities (i.e. coarse-grains and fine-grained) to serve different uses of the terminology?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>9. Multiple Consistent Views</td>
<td>Does the terminology provide multiple views so that it is suitable to be used for different purposes?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>10. Context Representation</td>
<td>Does the terminology contain context representation through formal, explicit information about how concepts are used?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>11. Evolve Gracefully</td>
<td>As the content and structure of the terminology changes are clear, detailed descriptions provided of what changes occur and why?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>12. Recognize Redundancy</td>
<td>Does the terminology permit the same information to be stated in two different ways (synonyms)?</td>
<td>SNOMED CT meets this requirement</td>
</tr>
</tbody>
</table>
Q1. What Value Does a Country Desire From a Clinical Terminology?

2. The American Health Information Management Association data quality management criteria was used to compare SNOMED CT and ICD-10. SNOMED CT met the requirements of all the criteria and out-performed ICD-10 on all counts.

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<tr>
<th>Terminology Criteria</th>
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<th>SNOMED CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Accessibility</td>
<td>Does the terminology easily support data accessibility?</td>
<td>SNOMED CT provides standardized data for use at the point-of-care, for data sharing and interoperability, as well as for analytics and research.</td>
</tr>
<tr>
<td>2. Accuracy</td>
<td>Is the terminology coded accurately?</td>
<td>SNOMED CT is an automated clinical terminology where clinical representations are automatically encoded using a variety of coding applications. This reduces the opportunity for human error.</td>
</tr>
<tr>
<td>3. Comprehensiveness</td>
<td>Is the terminology comprehensive in its breadth (i.e. the number of concepts and hierarchies)?</td>
<td>With 350,000 concepts in 19 hierarchies SNOMED CT is the most comprehensive clinical terminology available.</td>
</tr>
<tr>
<td>4. Consistency</td>
<td>Are the terminology concepts consistent among different users and across all clinical applications?</td>
<td>Concepts in SNOMED CT are the same among different users and across all clinical applications.</td>
</tr>
<tr>
<td>5. Currency</td>
<td>Is the content of the terminology kept current?</td>
<td>SNOMED CT in its current form was developed in 2007 and is updated twice per year.</td>
</tr>
<tr>
<td>6. Definition</td>
<td>Is the content of the terminology logical and well defined?</td>
<td>Developed by clinicians SNOMED CT’s logical structure is easy for clinicians to understand.</td>
</tr>
<tr>
<td>7. Granularity</td>
<td>Does the terminology have the depth necessary to support its intended use?</td>
<td>SNOMED CT is the most fine-grained clinical terminology available.</td>
</tr>
<tr>
<td>8. Precision</td>
<td>Does the terminology describe clinical expressions precisely?</td>
<td>Concepts have the same values in SNOMED CT; studies have shown up to 93 percent precision of SNOMED CT for identifying clinical expressions.</td>
</tr>
<tr>
<td>9. Relevancy</td>
<td>Is the terminology relevant for multiple uses?</td>
<td>SNOMED CT directly supports clinical care, information sharing and interoperability, point-of-care, population and management analytics, as well as research.</td>
</tr>
<tr>
<td>10. Timeliness</td>
<td>Is the input of the terminology content in real-time?</td>
<td>SNOMED CT data is automatically coded in real-time. It is not coded by humans after-the-fact.</td>
</tr>
</tbody>
</table>
Q1. What Value Does a Country Desire From a Clinical Terminology?

3. The ASSESS CT suitability evaluation of SNOMED CT for large scale e-health deployments within the E.U.

<table>
<thead>
<tr>
<th>Internal Terminology Criteria</th>
<th>SNOMED CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The terminology provides representational units (&quot;concepts&quot;) in sufficient granularity</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>across all areas of health care and biomedical research</td>
<td></td>
</tr>
<tr>
<td>2. The terminology is explicit regarding its scope.</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>3. The terminology is independent regarding language, but supports the connection to language</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>and context specific vocabularies</td>
<td></td>
</tr>
<tr>
<td>4. The terminology provides precise definitions of all representational units (&quot;concepts&quot;)</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>5. The terminology has a compositional architecture that allows fine-grained representations</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>6. The terminology can be harmonized with other terminological and semantic interoperability</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>assets in use</td>
<td></td>
</tr>
<tr>
<td>7. The terminology governed by a non-for-profit body that is controlled by end users and</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>stakeholders and can provide a forum for terminology knowledge sharing and collaboration</td>
<td></td>
</tr>
<tr>
<td>8. The terminology catches up with the progress of the domain by periodic updates</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>9. The terminology meets quality criteria for standards</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>10. The terminology supports sophisticated navigation and post-coordination</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>11. The terminology supports cross-border information and knowledge exchange</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>12. The terminology follows current specifications for semantic interoperability assets</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>13. The terminology is supported by user-friendly tools and is easily implementable</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>14. The terminology supports computer processing and is rooted in a rigid, understandable</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>upper-level model</td>
<td></td>
</tr>
<tr>
<td>15. The terminology has a maintenance process.</td>
<td>SNOMED CT meets this requirement</td>
</tr>
</tbody>
</table>
3. **The ASSESS CT suitability evaluation of SNOMED CT for large scale e-health deployments within the E.U.**

<table>
<thead>
<tr>
<th>External Terminology Criteria</th>
<th>SNOMED CT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The terminology is used internationally on other continents</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>2. The terminology supports cross-border use cases (epSOS Patient summary)</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>3. The terminology is in use in EU Member States</td>
<td>SNOMED CT meets this requirement</td>
</tr>
<tr>
<td>4. The cost of licenses, implementation and maintenance</td>
<td>SNOMED CT meets this requirement with reservations (see below)</td>
</tr>
<tr>
<td>5. The terminology has a compositional architecture that allows fine-grained representations</td>
<td>SNOMED CT meets this requirement</td>
</tr>
</tbody>
</table>

**ASSESS CT Identified Challenges**

- In 2016, SNOMED CT was not in widespread use within, or across, EU countries.
- The SNOMED CT license policy and cost is perceived as a critical barrier in the decision/start-up phase.
- The direct costs of adopting SNOMED CT (e.g. licensing costs) only constitute a small part of the overall costs to deploy the terminology within a country (note: this applies to all terminologies).
- The actual, or perceived, complexity of SNOMED CT is an initial barrier to adoption and use.
SNOMED CT is enhanced and maintained in a professional manner.

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<tr>
<th>Terminology Management</th>
<th>Description</th>
<th>SNOMED CT</th>
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<tbody>
<tr>
<td>1. Validated Content</td>
<td>Are any updates or changes in the terminology scientifically validated?</td>
<td>All SNOMED CT updates and changes are scientifically validated.</td>
</tr>
<tr>
<td>2. Extent of Use</td>
<td>Does the terminology have a wide base of use and support, either within the country, or globally?</td>
<td>SNOMED CT is used in over 80 countries and is strongly supported by a 40 national member base.</td>
</tr>
<tr>
<td>3. Language</td>
<td>Is there support to translate the terminology into the home language?</td>
<td>This is supported by SNOMED International. SNOMED CT has currently been translated into two languages (i.e. English and Spanish), with refsets in four additional languages.</td>
</tr>
<tr>
<td>4. Extensions</td>
<td>Can the terminology be extended with additional concepts, definitions and relationships?</td>
<td>SNOMED CT supports national, regional, or health entity extensions (e.g. Nebraska Lexicon).</td>
</tr>
<tr>
<td>5. Tools</td>
<td>Are there tools available to ease the burden of implementing and managing the terminology within a country or healthcare entity?</td>
<td>SNOMED International has developed open-source tools to support SNOMED CT deployment and management (e.g. authoring tool, SNOMED CT browser, mapping tool, Refset management and translation tool and the SNOMED CT managed service),</td>
</tr>
<tr>
<td>6. Education</td>
<td>Are there a variety of education programs to be available for implementers and users of SNOMED CT.</td>
<td>SNOMED International provides forums, EXPOS, focused education programs, and an extensive knowledge-base of documents and artefacts.</td>
</tr>
<tr>
<td>7. Participation</td>
<td>Are there opportunities countries to be involved in the governance of the terminology organization, and do they get the opportunity to interact with their peers?</td>
<td>SNOMED International is governed by the 41 Member General Assembly which sets the future direction for the organization. Through regular meetings and annual EXPOs SNOMED International provides opportunities for all countries to interact with their peers.</td>
</tr>
<tr>
<td>8. Cost</td>
<td>Is the terminology free to use?</td>
<td>SNOMED CT is free to use only for countries, healthcare entities and other organizations who have paid for a national or affiliate license.</td>
</tr>
</tbody>
</table>

4. Terminologies such as LOINC, RxNorm and ICD do not require a license fee and are free-to-use globally. However, like SNOMED CT these terminologies require funding to be maintained and enhanced. LOINC and RxNorm are primarily funded through U.S. Government agencies (e.g. Dept. of Health and Human Services), often in the form of project grants. ICD is funded through the World Health Organization’s 194 member country contributions plus private donors.
Q1. What Value Does a Country Desire From a Clinical Terminology?

The Terminology

- SNOMED International has designed the SNOMED CT clinical terminology so that it is fit-for-purpose. It meets all the 12 desired features of a controlled terminology as defined by Cimino.
- SNOMED International has designed the SNOMED CT clinical terminology so that it meets all the 10 quality data management criteria, as defined by the American Health Information Management Association.
- SNOMED International has designed SNOMED CT so that meets the suitability requirements of the E.U. community as determined by ASSESS CT through literature reviews, interviews and focus groups.

Management of the Terminology

- SNOMED International manages the SNOMED CT clinical terminology product and services in a professional manner.

The Desired Value of SNOMED CT is further Reinforced by:

- **F.U. Assessment** - after extensive stakeholder input and analysis, Assess CT (2016) evaluated SNOMED CT for use in large scale eHealth deployments in the European Union and recommended that:

  “SNOMED CT is the best available core reference terminology for cross-border, national and regional eHealth deployments in Europe”. - Assess CT
Q2. What Potential Value Does SNOMED CT Provide to a Country?

SNOMED CT
Case for Investment

Productivity (Model 1)
Cost savings from improvements in inpatient nursing time, lab tests, drug utilization, length of stay and medical records; plus outpatient transcription use, chart pulls, lab/radiology tests, & drug utilization.

Disease Prevention (Model 2)
Reduced bed days, workdays missed, as well as increased deaths avoided and life years gained from immunizations and cancer screening.

Patient Safety (Model 3)
Reduction in adverse drug events, inpatient bed days, and deaths avoided from CPOE use.

BCM & IRR (Model 4)
The Benefits Cost Multiple and the Internal Rate of Return from investing in clinical information systems and interoperability solutions.

Impact on GNI (Model 5)
The average annual increase to a nation’s GNI as a result of the investments in clinical information systems and interoperability solutions.

Break-Even Analysis

SNOMED CT
Data from Five Studies
Data from Model 1

The Case for Investment

SNOMED International
Q2. What Potential Value Does SNOMED CT Provide to a Country?

- Potential value is derived from modelling the quantitative impact of SNOMED CT-embedded clinical information systems and interoperability solutions (note: robust studies for health data & analytics platforms are not yet available). The U.S. RAND study used 2005 as a baseline and projected potential benefits to 2020 (i.e. for 15 years). The findings showed:

**Productivity Gains**

**Inputs:**
- The 2005 annual expenditure for healthcare in the United States was USD$2,024 billion.
- The adoption rate for integrated, clinical information systems was 15% in 2005 and this increased to 99.9% by 2020 (i.e. a significant investment in clinical information systems over the past 15 years).

**Outputs:**
- The estimated, potential annual mean savings as a result of the integrated, clinical information systems investment was USD$58.25 billion (i.e. approximately 3% of the 2005 annual U.S.A. healthcare expenditure).
- The estimated, potential cumulative savings over the 15 years was USD$875.8 billion.
- This was a result of patient service outcome benefits from inpatient care (i.e. nursing time, lab tests, drug utilization, length of stay and medical records) and outpatient care (i.e. transcription, chart pulls, lab tests, drug utilization and radiology).
Disease Prevention Benefits

**Inputs:**

- Total annual deaths (2005) from influenza, pneumococcal diseases, breast cancer, cervical cancer and colorectal cancer was 20,000, 40,000, 41,394, 4,100, and 57,000 respectively.
- The population over 65 with an annual (2005) diagnosis of influenza was 1,220,641 and pneumococcal diseases was 1,389,907.
- The proportion of people vaccinated (2005) for influenza and pneumococcal diseases was 65% and 53%.
- The percent of the population screened (2005) for breast cancer 70%, for cervical cancer 85% and for colorectal cancer 34%.

**Outputs:**

- Influenza vaccination resulted on average in 292,424 reduced bed days, 51,508 reduced workdays missed, and 1,298 deaths avoided.
- Pneumococcal vaccination resulted on average in 458,515 reduced bed days, 33,358 reduced workdays missed and 956 deaths avoided.
- Breast Cancer screening resulted in a mean of 1,976 deaths avoided.
- Cervical Cancer screening resulted in 338 deaths avoided and 8,437 life-days gained.
- Colorectal Cancer screening resulted in a mean of 1,392 deaths avoided and 39,654 life-days gained.
Patient Safety Benefits

The patient safety benefits are derived from the introduction of CPOE functionality in clinical information systems in the U.S. The HITECH Act of 2009 enabled significant investment to be directed toward CPOE as part of the Meaningful Use requirements. We have elected to use a recent CPOE adoption rate of 74% based on HIMSS EMRAM ratings. However, there are studies that indicate that e-prescribing in the U.S. may be higher than this number (i.e. 90%).

Inputs:

- The total annual inpatient days in the U.S. in 2005 was 167,199,099.
- The total annual outpatient visits in the U.S. in 2005 was 823,541,999.
- The CPOE adoption in the U.S. in 2005 was 4% and had risen to 74% by 2016.

Outputs:

- Inpatient benefits from increased use of CPOE functionality in clinical information systems resulted in:
  - A median of 100,974 reduced adverse drug events, 314,176 reduced bed days and 2,037 deaths avoided.
- Outpatient benefits from using CPOE functionality in clinical information systems resulted in:
  - A median of 1,078,953 reduced adverse drug events, 6,135,644 reduced bed days and 6,387 deaths avoided.
Benefits to Cost Model and Internal Rate of Return

Based on a range of studies the U.S.A. could anticipate a Benefits to Cost Multiple of 1.8 - 4.1 from an investment in SNOMED CT embedded clinical information systems and interoperability solutions. Alternatively, the Internal Rate of Return for the same investment would be in the range of 10-42% (i.e. the higher the IRR the more attractive the investment).

Economic Benefits

An increase in GNI has been empirically correlated with higher living standards, higher real incomes and the ability to devote more resources to areas like health care, education, research and development and capital investment. These measures in turn are correlated to higher literacy, life expectancy and higher technological innovation.

**Inputs:**
- The 2005 annual expenditure for healthcare in the United States was USD$2,024 billion.
- The 2005 GDP for the United States was USD$13,040 billion.
- The 2005 GNI for the United States was USD$13,170 billion.

**Outputs:**
- The average annual increase to U.S. GNI as a result of investments in integrated, clinical information systems was 0.23%.
- Further, the average annual increase to U.S. GNI was USD$30.71 billion.
Q2. What Potential Value Does SNOMED CT Provide to a Country?

In Summary

For the United States the potential cost savings, patient service outcome and patient health outcome benefits that can result from a targeted investment in integrated clinical information systems and interoperability solutions over 15 years are:

• Potential mean savings of USD$58.25 billion per year from improvements in inpatient nursing time, lab tests, drug utilization, length of stay and medical records and outpatient transcription use, chart pulls, lab tests, drug utilization and radiology services.

• Over 750,000 reduced bed days, approximately 85,000 reduced workdays missed and over 2,200 deaths avoided from influenza and pneumococcal disease immunizations.

• Over 3700 deaths avoided and 50,000 life-years gained from breast, cervical and colorectal cancer screening.

• A reduction of over 1.1 million adverse drug events and 6.4 million bed days, as well as 8,300 deaths avoided from CPOE use.

• A Benefits to Cost Multiple of 1.8 - 4.1 and an Internal Rate of Return for the same investment of 10-42%.

• The average annual increase to U.S. GNI as a result of the investments in clinical information systems and interoperability solutions was 0.23% or USD$30.71 billion.

• The estimated cost of implementing a SNOMED CT license in the USA for the study period was USD$87M. Using only the Model 1 cumulative benefits of USD$875.8B the breakeven percentage is 0.01%.

In conclusion, the potential value that SNOMED CT can provide a country is significant when it is embedded in clinical information systems and interoperability solutions.

5. Note: Potential Value should be viewed as directional, rather than absolute benefits. Ideally, potential value needs to be considered together with demonstrated value as a way to understand and project future patient outcome benefits. As such potential value should not be considered in isolation from other ways to determine benefits.
Q2. What Potential Value Does SNOMED CT Provide to a Country?

SNOMED CT
Potential Case for Investment

- **Productivity (Model 1)**: Potential mean savings of USD$58.25 billion per year in improved inpatient and outpatient services.

- **Disease Prevention (Model 2)**: Over 750,000 reduced bed days, approximately 85,000 reduced workdays missed and over 2,200 deaths avoided from immunizations, and over 3700 deaths avoided and 50,000 life-years gained from cancer screening.

- **Patient Safety (Model 3)**: A reduction of over 1.1 million adverse drug events and 6.4 million bed days, as well as 8,300 deaths avoided from CPOE use.

- **BCM & IRR (Model 4)**: A Benefits to Cost Multiple of 1.8 - 4.1 and an Internal Rate of Return for the same investment of 10-41%.

- **Impact on GNI (Model 5)**: The average annual increase to U.S. GNI as a result of the investments in clinical information systems and interoperability solutions was 0.23% or USD$30.71 billion.

The estimated cost of implementing a SNOMED CT license in the USA for the 15-year study period was USD87M.

Using only the Model 1 cumulative benefits of USD$875B the breakeven percentage is 0.01%.
SNOMED CT
A Demonstrated Case for Investment: Real World Use
Patient Outcome Benefits across the varied applications of SNOMED CT

Patient Service Outcome Improvements
- Patient (Panel) Management
- Health Record Management
- Diagnostic Tests
- Patient Safety
- Infection Control
- Referral Management
- Population Health
- Data Sharing
- Efficiencies and Cost Savings

Patient Health Outcomes Improvements
- Patient Safety
- Infection Control
- Population Health
- Analytics and Research

Q3. What Demonstrated Value Has SNOMED CT Provided a Country?

SNOMED CT – embedded Clinical Information Systems, Health Data & Analytics Platforms and Interoperability Solutions

FULL REPORT
The **demonstrated value** of SNOMED CT is derived from the ten case studies where exemplar, SNOMED CT-embedded clinical information system, health data & analytics platform and interoperability solution deployments were reviewed. Throughout this report the demonstrated value has been presented as **patient service outcome** and **patient health outcome** benefits.
Q3. What Demonstrated Value Has SNOMED CT Provided a Country?

Note: The analytics and research examples shown here are an extremely small subset of what has been completed by healthcare organizations around the world. Further, with the more recent deployment of advanced analytics capabilities (i.e. point-of-care analytics, population analytics and management analytics), the impact on patient safety, infection control, population health and other areas of healthcare is expanding rapidly and may not be reflected in this table.

<table>
<thead>
<tr>
<th>Patient Health Outcome Benefits</th>
<th>Population Health</th>
<th>Analytics and Research (some examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Reduction in patient harm</td>
<td>10. Improved control of diabetes</td>
<td>19. Improved chlorthalidone vs hydrochlorothiazide hypertension safety</td>
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<tr>
<td>5. Reduction in mortality due to best practice review of ventilator tidal volumes</td>
<td>13. Improved control of breast cancer</td>
<td>22. Increased precision in identifying cancers (AI)</td>
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<tr>
<td>Infection Control</td>
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<tr>
<td>7. Reduced infection transmission rates</td>
<td>15. Improved control of colon cancer</td>
<td>24. Improved identification of antibiotic resistance (AI)</td>
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<tr>
<td>9. Improved control of cholesterol</td>
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<td></td>
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<tr>
<td>10. Improved control of diabetes</td>
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<tr>
<td>11. Improved control of high blood pressure</td>
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<tr>
<td>12. Improved control of cardiovascular disease</td>
<td></td>
<td></td>
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<tr>
<td>13. Improved control of breast cancer</td>
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<td></td>
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<tr>
<td>14. Improved control of cervical cancer</td>
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<td></td>
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<tr>
<td>15. Improved control of colon cancer</td>
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<td></td>
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<tr>
<td>16. Improved control of COVID-19</td>
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<tr>
<td>17. Reduction in morbidity and mortality</td>
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</table>
Patient Outcome Benefits

- The use of SNOMED CT-embedded clinical information systems have demonstrated a wide range of patient service outcome benefits: health records management, patient/panel management, patient safety, diagnostic tests, infection control, referral management, data sharing/interoperability, population health, efficiencies and direct cost savings.

- The use of SNOMED CT-embedded clinical information systems have resulted in patient health outcome benefits: patient safety, infection control, referral management, population health, and the impacts of analytics and research studies.

- Therefore, SNOMED CT when embedded in clinical information systems, health data & analytics platforms and interoperability solutions has demonstrated value that enable improved patient outcomes, and in part mirror the potential value shown in the modified RAND study of the U.S.

The Proof of Demonstrated Value of SNOMED CT is further Reinforced by:

1. **Size of the Existing User Base** - 41 member countries and over 80 countries where the terminology is used.

2. **Clinical Information System Products** – By one count (i.e. KLAS), SNOMED CT is available in approximately 72% of the clinical information system products globally (note: this does not include the China or Russia markets).

3. **Exemplar Implementations** - In healthcare organizations like: Veterans Health Administration (U.S.), Kaiser Permanente (U.S.), BARTS NHS Trust, ELHCP and OneLondon (U.K.), and Cambridge University Hospitals NHS Foundation Trust (U.K.).
SNOMED CT

Future Value

Personalized, Precision Medicine 2030

1. **Huge Interoperable Longitudinal Cohorts** - Over the last 20 years, national cohorts (e.g. UK Biobank), have amassed huge populations with genomic, laboratory, and lifestyle assessments as well as longitudinal follow-up on health outcomes. The breadth and depth of data is staggering, as is the opportunities for discovery.

2. **Diversity and Inclusion** - With a growing depth of data, we have an opportunity to replace adjustments for race and ethnicity with more specific measures.

3. **Big Data and AI** - AI approaches in medicine have been limited by the (un)availability of large, commonly structured datasets. Looking forward, biomedical datasets will become increasingly ready for analyses.

4. **Routine Clinical Genomics** – Moving forward, whole genome approaches will become a routine, early step in the understanding, prevention, detection, and treatment of common and rare diseases.

5. **Electronic Health Records** – Many site-based and national research cohorts now use EHRs and other health data to provide up to decades of disease and treatment information that can be repurposed for research. This use will continue to expand.

6. **Phenomics and Environment** – Continued growth of research and clinical uses for different ways to measure clinical phenotypes, exposures, and lifestyles.

7. **Privacy, Trust and Return of Value** - The utility of precision medicine is dependent on broad participation, and broad participation of large populations requires trust, protection of privacy, and a return of value to the participants.8

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Q4. What are the Future Opportunities for SNOMED CT Use?

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Case for Investment

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FULL REPORT
The healthcare industry is ever evolving. The future opportunities for SNOMED CT will be driven by new healthcare data sources and new healthcare technologies.

From a health care industry-wide perspective the following new data sources and technologies are seen as significant.

**New Data Sources** – unstructured-to-structured data, “omics” data.

**New Technologies** – machine learning, artificial intelligence, deep learning, blockchain, biosensors, advanced semantic interoperability, differential privacy, quantum computing.

However, ‘omics’ data coupled with artificial intelligence, machine learning, deep learning and other technologies are drawing the most attention globally given their contribution to the field of personalized, precision medicine.
**Personalized, Precision Medicine**

The ability to digitize the medical essence of a human being is predicated on the integration of multiscale data, akin to a Google map, which consists of superimposed layers of data such as street, traffic, and satellite views. For a human being, these layers include demographics and the social graph, biosensors to capture the individual’s physiome, imaging to depict the anatomy (often along with physiologic data), and the biology from the various omics (genome-DNA sequence, transcriptome, proteome, metabolome, microbiome, and epigenome). In addition to all of these layers, there is one’s important environmental exposure data, known as the “exposome.”

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Q4. What are the Future Opportunities for SNOMED CT Use?

**Personalized, Precision Medicine 2030**

Personalized, precision medicine promises improved health by accounting for individual variability in genes, environment, and lifestyle. It will continue to transform healthcare in the coming decade, and beyond, as it expands in key areas: huge cohorts, artificial intelligence (AI), routine clinical genomics, phenomics and environment, and returning value across diverse populations.

**SNOMED CT** as a core reference clinical terminology is well-positioned to enable the semantic ‘interoperation’ and knowledge representation of massive, diverse health data sets, using advanced technologies (e.g. AI/ML), that need to be positioned for personalized, precision medicine, analytics and research.
### SNOMED CT

**Why would a Country Invest in SNOMED CT?**

| Desired Value | SNOMED CT is a best-in-class, core clinical reference terminology that is well-designed, comprehensive, serves multiple uses, is widely adopted, and enables improved patient outcomes – it clearly passes the bar for the value that a country desires from a clinical terminology and as such makes for a Strong Case for Investment. |
| Potential Value | Through the modelled deployment in clinical information systems and interoperability solutions SNOMED CT has clearly shown strong potential value and as such makes for a Strong Case for Investment. |
| Demonstrated Value | The ten Case Studies clearly demonstrate the value that SNOMED CT can bring when used in clinical information systems, health data & analytics platforms and interoperability solutions, and again make for a Strong Case for Investment. |
| Future Value | Future opportunities, especially in personalized, precision medicine and research, using advanced technologies, are a perfect fit for SNOMED CT, which in turn bolsters its Strong Case for Investment. |

**The SNOMED CT Case for Investment**

\[
\text{Desired Value} + \text{Potential Value} + \text{Demonstrated Value} + \text{Future Value} = \text{Strong Case for Investment}
\]
There is a demonstrated STRONG CASE FOR INVESTMENT in SNOMED CT.
Experience the value of SNOMED CT

Read the full report and visit the value platform at:

snomed.org/value