THE PROBLEM LIST – a succinct summary of a patient's most important medical issues – is an essential tool for well-informed and well-coordinated care. "Maintaining an up-to-date problem list of current and active diagnoses" is a key requirement for meaningful use of certified electronic health records (EHRs).

Meaningful Use Stage 1 allows certified EHRs to encode medical problems in either ICD-9-CM or SNOMED CT. Because billing diagnoses have been encoded in ICD-9-CM, many EHRs and providers currently use ICD-9-CM to encode medical problems as well. Even so, it has been clear that SNOMED CT is a superior choice for encoding medical problems. As a more flexible and expressive terminology, it more precisely fits the way clinicians think about medical issues. It is also more suitable for tools to improve patient care, such as computerized decision support systems. Recognizing the advantages of SNOMED CT, by 2014 Meaningful Use Stage 2 will allow only SNOMED CT for encoding medical problems. Billing diagnoses will continue to be encoded in ICD-9-CM (moving to ICD-10-CM in October 2014).

This "diagnosis versus problem" issue poses multiple challenges for EHR vendors. First, there is a legacy set of problems recorded in ICD-9-CM that must be transposed to SNOMED CT. Because the problem list contains critical information, the conversion process demands fidelity, but must also minimize demands on busy clinicians. In addition, EHR vendors may need to accommodate clinicians' expectations that diagnoses can be added to the problem list, even though diagnoses and problems will be encoded in different vocabularies. Both of these challenges would be easy to meet if every diagnosis in ICD-9-CM had only a single match in SNOMED CT. Unfortunately, publicly available maps from ICD-9-CM to SNOMED CT, while useful, are unable to provide one-to-one matches in one third of cases, and do not provide enough fidelity in mapping to be used in automated conversion of legacy ICD-9-CM diagnoses.

To help EHR vendors meet these challenges, Health Language Inc. (HLI) has enhanced its Language Engine (LE) to facilitate reliable conversion of ICD-9-CM to SNOMED CT in problem lists. Using clinically valid assumptions, LE provides maps that maximize one-to-one matches of ICD-9-CM diagnoses to SNOMED CT problems. When an ICD-9-CM code still requires a combination of pre-coordinated SNOMED CT codes (a|AND|b) or a choice between codes (a|OR|b), LE provides a mechanism that allows EHRs to maintain and use a single SNOMED CT entry in its problem lists, without requiring support for complex post-coordinated expressions. Combined with HLI's provider-friendly terminology, these new resources allow EHR vendors to provide a meaningful-use compliant product that maximizes the benefits of SNOMED CT-encoded problems while minimizing clinician effort in the conversion process.

Maximizing one-to-one maps: Some concepts in ICD-9-CM have "catch-all" phrases to assist in coding medical records. For instance, the commonly used code 250.00 is defined as "Diabetes mellitus without mention of complication, type II or unspecified type, not stated as uncontrolled." Phrases such as "without mention of," "or unspecified type," and "not stated as" provide useful guidance to coders who must assign codes based on clinical documentation that is often incomplete. However, ICD-9-CM catch-all phrases often introduce ambiguity

that predisposes to combinatorial maps to SNOMED CT. For instance, a direct interpretation of the phrase "type II or unspecified type" implies that this IDCD-9-CM concept should be mapped to SNOMED CT as '44054006 Diabetes mellitus type 2'|OR|'73211009 Diabetes mellitus.' While this map is valid, ambiguous combinatorial maps like this one complicate transposition of ICD-9-CM encoded problem lists. When a problem list contains ICD-9-CM code 250.00, should this concept be transposed to the most generic SNOMED CT code in the combinatorial (diabetes mellitus of unspecified type)? Or should clinicians be asked to review all charts with 250.00 on the problem list to decide whether the intention was to code type 2 diabetes mellitus or diabetes mellitus of unspecified type? Neither is a good solution, because in practice this code nearly universally indicates type 2 diabetes mellitus. To address this, HLI applies pragmatic rules to "catch-all" phrases to maximize customary and clinically valid one-to-one ICD-9-CM to SNOMED mapping for problem lists – in this case to '44054006 Diabetes mellitus type 2.'

"Preferred maps" when combinatorial mapping is required: Some concepts in ICD-9-CM by their nature cannot be mapped to a single pre-coordinated concept in SNOMED CT. Two examples are provided in the Table.

ICD-9 Code	SNOMED CT Combinatorial	SNOMED CT HLI Extension Concept
682.6 Cellulitis and abscess of leg, except foot	'287001000 Cellulitis of leg, excluding foot' |OR| '28691000 Abscess of leg, except foot'	5028651000138101
209.31 Merkel cell carcinoma of the face	'253001006 Merkel cell carcinoma' |AND| '449211009 Carcinoma of face'	5029661000138105

In these situations, the Language Engine provides maps from the ICD-9-CM concept to multiple SNOMED CT concepts, and also supplements many of these with "preferred maps."

- Every extension concept for an |OR| combinatorial includes a preferred map that, while not a sufficient one-to-one map, is a reasonable default choice in a pick list. For example, the preferred map for '682.6 Cellulitis and abscess of leg, except foot' in the Table is '287001000 Cellulitis of leg, excluding foot.'
- Some |AND| combinatorials include a preferred map that is not completely semantically equivalent but may be a reasonable one-to-one map for a problem list. For example, while '642.43 Mild or unspecified pre-eclampsia, antepartum condition or complication' is mapped to both '41114007 Mild pre-eclampsia'|AND|'289257009 Mother not delivered, ' the preferred map ('41114007 Mild pre-eclampsia') is likely to suffice as a one-to-one map for use in the problem list.

Availability of SNOMED extension concepts to bridge the gap between ICD-9-CM and SNOMED CT: The existing data structures of some EHRs make it difficult to accommodate combinatorial mappings from ICD-9-CM to SNOMED CT. They may only be able to associate an ICD-9-CM concept with a single mapped SNOMED CT target. To assist EHRs in converting ICD-9-CM encoded problems to SNOMED CT, and to facilitate transposition of medical problems and billing diagnoses, HLI has created SNOMED CT extension concepts for these combinatorials. The HLI extension concepts provide a bridge between ICD-9-CM and SNOMED CT, allowing an ICD-9-CM code to have a 1:1 map to an extension concept that shares the same display term as the ICD-9-CM code and retains the semantic meaning of the SNOMED CT combinatorial.

For instance, ICD-9-CM code 209.31 in the Table can initially be transposed to the extension concept '5029661000138105 Merkel cell carcinoma of the face' and later broken into its constituent standard SNOMED CT concepts for health information exchange. ICD-9-CM code 682.6 can be transposed to the extension concept '5028651000138101 Cellulitis and abscess of leg, except foot' until the choice between cellulitis and abscess can be clarified.

About Health Language, Inc.

Health Language software manages medical terminology to create true healthcare IT interoperability. With the Language Engine® (LE®) and other tools from Health Language, Inc. you can meet the demands of ICD-10 conversion, Meaningful Use, and healthcare IT interoperability across an enterprise of any size, from a single hospital to the largest provider or payer organization. With Health Language your organization can have a consistent, up-to-date "source of truth" for the medical terminology used by healthcare IT applications.