# HL7 Version 3 Domain Analysis Model: Health Concern, Release 1

August 2016

## HL7 Informative Document

**Sponsored by: Patient Care**

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## Content

# Revision History

| Version | Date | Name | Comment |
|---------|------|------|---------|
| 1.0 | August 2, 2014 | Patient Care WG | First Informative Ballot |
| 2.0 | December 7, 2014 | Patient Care WG | Second revised Informative Ballot |
| 3.0 | May 2015 | Patient Care WG | Third revised Informative Publication |
| 4.0 | September, 2015 | Patient Care WG | Third revised Informative Ballot |
| 4.1 | May, 2016 | Patient Care WG | Fourth revised Informative Ballot |
| 4.2 | September 2016 | Patient Care WG | Final Publication |

# 1 Introduction

Healthcare delivery is becoming more complex. Patients, especially those with complex health issues, are treated by multi-disciplinary teams of providers across care settings. Institutions may specialize in one clinical area or super-specialty care. Patients with a history of multiple complex health issues provide a care coordination challenge across institutions. Providers need a robust mechanism to disambiguate clinical findings, keep track of how comorbidities relate to and affect one another, and monitor the impact of different interventions on the progress of the patient's various conditions. These ideas [1] were first described by Dr. Lawrence Weed in his article about Problem Oriented Medical Records but now needs extra considerations, because of the requirement to be able to track across institutions and IT systems. Other persons, including patients, also need a way to communicate to the care team. The Health Concern Domain Analysis Model is intended to provide a method to assist in care coordination considering the perspectives (concerns) of different persons and organizations.

HealthConcerns are closely related to 'Problems' as typically recorded on a 'Problem List' in most EMRs. The concepts are note entirely synonymous because of ambiguity in the use of the word 'Problem'. The word 'Concern' was chosen to reflect distinctions relevant to correctly recording 'Problems' as they typically occur on 'Problem Lists'. These include:

1) the distinctions between a 'Medical Condition' as opposed to intent to act about the medical condition such as follow the status of it.
2) the distinctions to support the need to act on or follow issues which are not medical conditions but instead reflect events, risks or other situations.
3) The distinctions required to support multiple roles and perspectives such as the patients view of their conditions.
4) The need to distinguish between the need to record static and stable data to support billing and historical purposes, as opposed to the need to record an ongoing issue that may evolve and change with time.

An appendix outlines how the Health Concern concept is related to C-CDA Release 2.1, where templates are defined about the health concern, problem concern, and risk concern concepts, as well as the ISO/DIS 13940 (Systems of Concepts to support continuity of care) to facilitate harmonization of concepts between projects.

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[1] L. Weed MD, Medical Records that guide and teach, New England Journal of Medicine, March 21 1968

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## 2   The Domain Analysis Model Artifact

A Domain Analysis Model (DAM) is a Unified Modeling Language (UML) representation of a "domain," or area of business requirements. It is a requirements artifact—also known as a "problem domain," "conceptual" or "business" artifact. It is designed to articulate clearly the needs of the business community as that community understands them. A DAM informs the reader about the domain information, but it doesn't tell you how to represent it in an information system.

In the words of the *HL7 Development Framework* (HDF), "During requirements documentation the problem domain is defined, a model of the domain (or problem space) is produced as the DAM consisting of static and dynamic model artifacts. Domain, in this case, refers to the problem space for the requirements." The critical distinction is that the DAM does not specify patterns for representing the data. It does not conform to the HL7 Reference Information Model (RIM), or to openEHR, or to any other logical pattern, as it must represent the problem domain with sufficient clarity to support development in any of those patterns.

The HDF clarifies: "A DAM defines what needs to be done, not how to do it. It is important to separate the description of requirements from the design of the solution. Prematurely including technical and implementation details will compromise the clarity of the original problem and will result in standards that fall short of the business needs. The DAM is [*subsequently*] used to create standard specifications by harmonizing it with HL7 references including the RIM, structural vocabulary, and application roles."

The DAM contains of both a dynamic part—with definitions for actors and the use cases they participate in—and a static part—illustrating the structure of the concepts used in those use cases. The use cases are abstracted from a set of concrete scenarios identified by domain experts.

# 3 Introduction to Health Concerns

## 3.1 Characteristics of a health concern

The topic of health concerns has a long history of debate and trial concepts. The consequence is that in the long run various definitions have been used in different settings. In this domain analysis we try to harmonize the concepts with the intention that the different standards, such as HL7v3, CDAr2 and FHIR can have a common understanding of the concept of health concerns.

- A health concern is a health-related matter that is of interest, importance or worry to someone whether it be the patient, a member of the patient's family, or a healthcare provider.
- Deciding that something is a health concern is volitional and intentional. It represents the determination by an individual that a specific health condition, or issue, is of interest, important to document, and may require monitoring and intervention.
- Health concerns may represent variations from a desired health status, or a condition or situation that place the patient at risk for an undesirable health status, and thus may need management or attention. A pregnancy is an example of a condition which may or may not be desired in and of itself, but at minimum requires management because it places special risks on the patient and fetus that could create an undesirable outcome if not properly managed. Health concerns are not always biological in nature: social factors, family dynamics or relationships (e.g., loss of family members, domestic violence), economic stress, risks, etc., may be identified as health concerns.
- The health concern is the focus with which care providers recognize which health items are related to a health concern, and thus make tracking and tracing possible of the progress of the patient. In this document we call it monitoring.

## 3.2 Requirements

These requirements are the fundamental needs that are met by the Health Concern model, derived from the supplied use cases:

1. **Provide a way to indicate which things are of concern**.
   The Health Concern concept allows people to indicate which facts are actually of concern (e.g., a "Problem List" for a physician) and should be made evident to care providers and other care team members.
2. **Support different persons' and roles' perspectives**.
   Different users will have different needs and expectations regarding what is actually of concern.
3. **Maintain a traceable record of a concern, for understanding, as the concern evolves.**
   As providers investigate health issues, their understanding of the underlying issue often changes. However, it is sometimes important to be able to understand that today's diagnosis is the same problem that initially presented as something else--pneumonia as the flu, or gastritis as chest pain. This ability is especially important when reconciling data across organizations.
4. **Associate events with concerns in order to provide a consolidated view of a concern.**
   The ability to assign specific data to a concern will allow a user to see the information associated with a concern without having to sort through extraneous data. Some systems may

be able to perform these assignments by rule (e.g., observations ordered in the context of caring for a particular concern), but the ability to assert a relationship is fundamental.

## 3.3  Implications of the Concept

We also observe some implications of this concept.

- Health concerns can be created by different persons in different systems without knowing about each other. Therefore, the ability to aggregate and reconcile concerns is desirable, although the concerns of one person may differ in relevance, granularity, or certainty compared to those of another. Ownership of a health concern is often a policy matter within an institution.
- It is possible to generate different kinds of lists containing the subset of health concerns that meet certain criteria - an allergy list, for instance, or a particular provider's problem list. Prioritization of the concerns within a provider's list is outside the specifics of this model as they are most frequently assigned by the provider or through software weighting.
- We distinguish between the Health Concern and its constituent parts, which we collectively call "events." The parts will include, at least, one event that is the identifying event (e.g., a diagnosis, or the patient asserting a new complaint). It may include subsequent identifying events, if the understanding of the concern evolves. And it may include other events of interest, in order to support requirement 4, "Associate events with concerns in order to provide a consolidated view of a concern".  Note that this means that a diagnosis may be the identifying event for a concern, but it is not the concern itself. The concern persists and may change over time, but the diagnosis is a record of an assertion at a point in time.
- Health Concern events may be issue(s), condition(s), problem(s), diagnosis/diagnoses, barrier(s) or other physical or environmental component facts which may be linked to a set of supporting information including complaints (by patient and/or patient representative), signs, symptoms, diagnostic and findings. They may also include risks which can be assessed, may have an intervention and can be monitored but may not appear on the problem list.

Figure 1 illustrates the identification and continuous tracking of a health concern. The patient initially noted pain shooting down the left leg. Two weeks later, the patient began to feel lower back pain in addition to the leg pain and decided to seek consultation with the Primary Care Provider (PCP). After conducting a set of initial clinical assessments (not shown), the PCP made a diagnosis of sciatica. Diagnostic imaging tests were ordered and the results led to the revision of the diagnosis to herniated intervertebral discs.
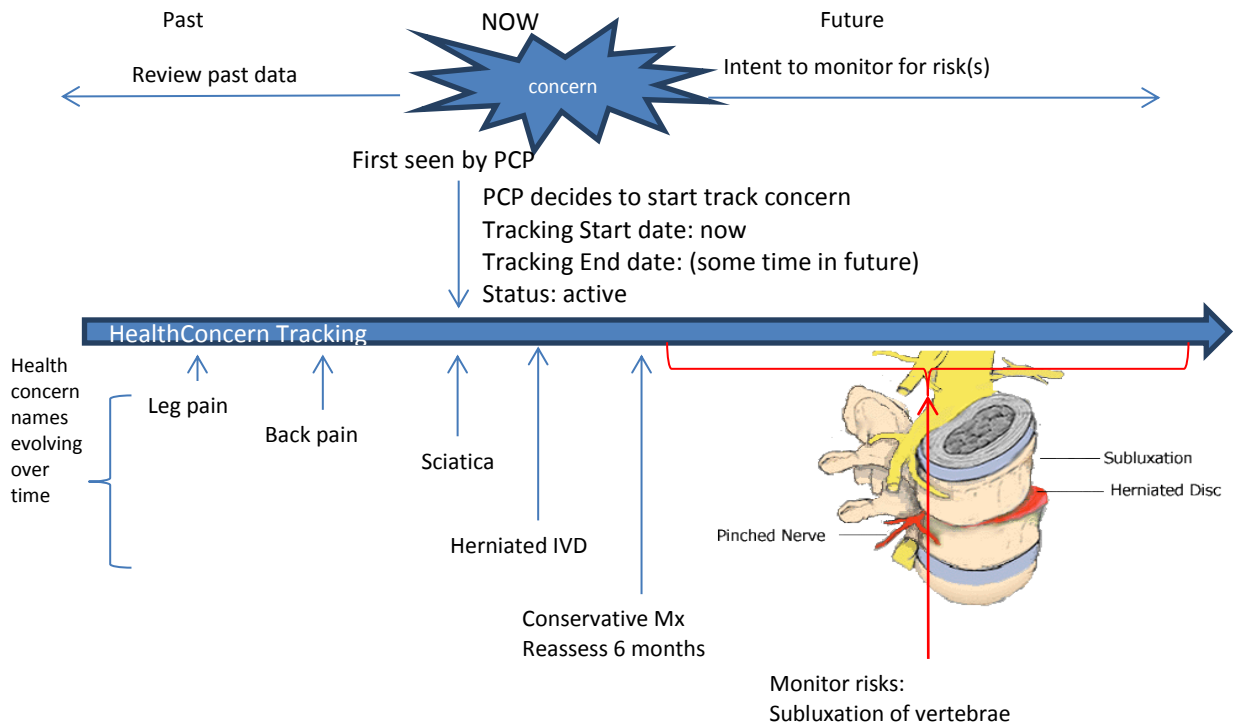
Figure 1 Example of back pain concern tracking

The PCP decided to track the HealthConcern when making the diagnosis of sciatica. The health concerns were traced back to the date when the first symptom (leg pain) was noticed by the patient. At each point in time, the name of the HealthConcern changed as the condition evolved.

The PCP discussed management options with the patient, who rejected surgical intervention and opted for conservative management. The PCP discussed with the patient a plan to monitor the condition (as a HealthConcern) and the potential risk of subluxation of the affected vertebrae. The diagram in section 5.5 shows the relation of this example to the HealthConcern model.

# 4   A Typical Use Case for HealthConcern and HealthConcern Tracking

To help clarify the abstract nature of HealthConcern Tracking, an example patient history may be used.

A 55-year-old patient with known Type I Diabetes presented to his Primary Care Physician (PCP) with chief complaints of cough and slight shortness of breath. There was no wheezing on examination.

A week later, he returned to see his PCP with presenting symptoms of cough, shortness of breath and fever.

Two days later, he presented himself at the Emergency Department (ED) of local hospital with cough, severe shortness of breath, wheezing and fever.

In the Emergency Department he was diagnosed with asthma and pneumonia, was admitted, and treated in the hospital for two days. During this hospitalization, he is noted to have problems with his diabetes control and a new allergy is noted. After the hospitalization, the patient is discharged back to the care of his PCP, and sees that provider a week later.

The example will illustrate communication between two systems which share similar event structure. Each of the above events is recorded in the electronic health records as an individual HealthConcernEvent. The sum of all recorded events represents the patients' medical history as understood by the computers.

In our example, let us examine where and how these concern identifiers are established. Without concern tracking, all of the events simply record the history of the patient as seen within the Electronic Health Record (EHR). The patient's diabetes, asthma, and pneumonia are documented together in a chronological manner. However, it is not possible to match up that elevated glucose on 3/14 is related to diabetes, or that the Rocephin was related to the ED admitting Dx: pneumonia, but unrelated to problem of diabetes. Any relation between problem or allergy list entries are unable to be stated.

With concern tracking, the events are typically entered based on a concern identifier as a starting point. For example, in this case, the physician might order the chest x-ray (CXR) in the context of a concern that started with the registration event cough and dyspnea (later renamed possible pneumonia and finally winding up as S/P pneumococcal pneumonia). Furthermore, the EHR may allow for additional tagging or changing of relationships within a concern history, however the implementation details may vary significantly from system to system, where some systems may only track major name changes, others might record that a particular note exists related to the concern, and others might use sophisticated inference to automatically bind concerns and orders and results based on known relationships. An example of the latter is that glucose results are generally relevant for diabetes so any observation of a concern recently named "Diabetes Type 1, uncontrolled" might automatically include glucose results.

Table 4.1
**System A – Ambulatory Office System**

| | Clinical Event | | | Concern | | |
|---|---|---|---|---|---|---|
| **Ref** | **Date** | **Description** | | **Action** | **Concern No.** | **Comments** |
| 1 | 11/20/14; 1000 | New patient presents at PCP office | | | | |
| 2 | 11/20/14; 1015 | Encounter note: Exam confirms *controlled diabetes* | | **Create concern** #A1 *controlled diabetes* | A1 | |
| 3 | 3/4/14; 1430 | Patient presents at PCP office | | | | |
| 4 | 3/4/14; 1435 | Registration of <u>patient</u> complaint: *cough & dyspnea* | | **Create concern** #A2 *cough & dyspnea* | A2 | |
| 5 | 3/4/14; 1440 | Encounter note- *no wheeze* | | **Add assessment event** of "no wheeze" to Concern ID #A2 *Cough/Dyspnea.* | A2 | Exam findings would generally be used as concern naming observations. |
| 6 | 3/4/14; 1440 | Encounter note assessment of probable Viral URI | | **Add naming assessment event** of probable Viral URI to concern ID #A2 | A2 | In the encounter note, the Assessment/Plan section, the "Assessment" (sometimes called "Impression") is an observation event that may re-name the concern at that point in time. In this case, the name of the concern is now changed to "Probable Viral URI" |
| 7 | 3/11/14; 0920 | Patient presents at PCP office | | | | |
| 8 | 3/11/14; 0920 | Patient complaint at registration is *cough, dyspnea, fever* | | **Create concern** #A3 *cough, dyspnea & fever* | A3 | Registration or a nurse might, without being aware of the existing concern (#A2), create a new concern - #A3. It can be corrected later by merging with concern #A2 after it is realized that #A3 represents the same complaint/concern. |

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| Clinical Event | | | | Concern | | |
|---|---|---|---|---|---|---|
| Ref | Date | Description | | Action | Concern No. | Comments |
| | | | | | | When merged, the name of the concern would be selected from #A2 or #A3. |
| 9 | 3/11/14; 0930 | Encounter note – exam indicates *crackles but no wheeze* | | **Add assessment event** to A2 stating *crackles but no wheeze* | A2 | Concern #A3 was merged to existing #A2 concern |
| 10 | 3/11/14; 0930 | Encounter note: Exam: Assessment *Possible community-acquired pneumonia* | | **Add naming assessment event** to #A2 which renames concern #A2 to *Possible community-acquired pneumonia* | A2 | Changes the concern name <u>going forward</u>. History does not change |
| 11 | 3/11/14; 0930 | Order is created for the med *azithromycin* | | **Add event** to #A2 that azithromycin was ordered | A2 | |
| 12 | 3/11/14; 0930 | Order is created for a *Chem7 lab panel* | | **Add event** to #A2 that lab test was ordered | A2 | |
| 13 | 3/11/14; 0930 | Order is created for *chest x-ray* | | **Add event** to #A2 that a chest x-ray was ordered | A2 | |
| 14 | 3/11/14; 1210 | Lab *WBC* arrives | | **Add event** to #A2 that records *WBC result* | A2 | |
| 15 | 3/11/14; 1210 | Lab *glucose* result arrives | | **Add event** to #A2 that records *glucose result* | A2 | Link to Concern #A2 because of the order there is in the context of Chem7. However, it might later be tagged as part of # A1. The same event may be tagged to multiple concerns (#A1 & #A2) |
| 16 | 3/12/14; 1330 | *Chest x-ray* result arrives | | **Add event** to #A2 that records *chest x-ray result* | A2 | |
| 17 | 3/12/14; 1632 | Telephone note: Patient advised to go to the hospital | | **Add event** to #A2 confirmation that patient has *pneumonia* | A2 | #A2 name amended to <u>confirmed</u> *pneumonia* |

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| Clinical Event | | | | Concern | | |
|---|---|---|---|---|---|---|
| Ref | Date | Description | | Action | Concern No. | Comments |
| | | | | **Add event** to #A2 that patient advised to go to the hospital | | |

In this example, the hospital/ED is a separate system and concerns are prefixed B. The patient arrives without an electronic transmission from the ambulatory system so a new concern is started. If this had been the same system, then concern IDs could/would be carried forward. If an electronic transmission were received the history would be merged and reconciled. This is shown later in the example.

Table 4.2
**The ED/Hospital System**

| Clinical Event | | | | Concern | | |
|---|---|---|---|---|---|---|
| Ref | Date | Description | | Action | Concern No. | Comments |
| 18 | 03/13/14; 0732 | New patient presents at the ED | | | | |
| 19 | 03/13/14; 0732 | ED triage records complaint: *Cough, shortness of breath fever* | | **Creates concern** #B1, *cough, shortness of breath, fever* | B1 | |
| 20 | 3/13/14; 0745 | ED Physician note: Exam indicates wheeze, crackle, fever | | **Add assessment event** to #B1, include exam finding of *wheeze* | B1 | |
| 21 | 3/13/14; 0750 | ED physician examines X-ray of 3/12/14 (see Ref 13 & 16) | | **Add naming assessment event to** #B1 with diagnosis of *pneumonia* | B1 | Also, Concern #B1 name is revised to *pneumonia* |
| 22 | 3/13/14; 0750 | ED order is placed for the med Rocephin | | **Add order event** for the med Rocephin | B1 | |
| 23 | 3/13/14; 0900 | Patient is admitted to the inpatient floor | | **Add admission event** to #B1 | B1 | As the ED and the floor are operating on the same system, the initial #B1 concern is used, this event reference needs to remain static regardless of future name changes to B1 |
| 24 | 3/13/14; 1015 | Admitting physician enters admitting Dx of *pneumonia* | | **Add event** of confirmation of *pneumonia* | B1 | |

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| | Clinical Event | | | Concern | | |
|---|---|---|---|---|---|---|
| Ref | Date | Description | | Action | Concern No. | Comments |
| 25 | 3/13/14; 1030 | Admitting physician enters admitting Dx of *probable asthma* | | **Create new concern** #B2 of *probable asthma* | B2 | |
| 26 | 3/13/14; 1020 | Admitting physician enters H&P assessment of *Diabetes, Type 1, controlled* | | **Create new concern** #B3 of *diabetes, type 1, controlled* | B3 | The H&P assessment of diabetes type 1 is essentially a patient complaint/concern |
| 27 | 3/14/14; 0540 | POC Lab *glucose* performed to validate potential dx | | **Add event** to #B3 to record *glucose* test request | B3 | |
| 28 | 3/14/14; 0640 | Place order with pharmacy for insulin | | **Add event** to #B3 of *insulin* order | B3 | |
| 29 | 3/14/14; 0930 | Order lab *sputum gram stain* test | | **Add order event** to #B1 for *sputum gram stain* | B1 | |
| 30 | 3/14/14; 1010 | SOAP subject: complaint of *rash/itch* | | **Create new concern**, #B4 | B4 | This is a <u>patient</u> complaint concern |
| 31 | 3/14/14; 1015 | SOAP exam: *salmon-colored maculopapular rash* | | **Add event** to #B4 of *salmon-colored maculopapular rash* | B4 | |
| 32 | 3/14/14; 1015 | SOAP assessment: *likely drug reaction* | | **Add assessment event** of *likely drug reaction* | B4 | This would also include a revision to the name for #B4 to *drug reaction* |
| 33 | 3/14/14; 1015 | Discontinue *Rocephin* order | | **Add order discontinue event** to #B4 | B4 | This event is <u>also recorded</u> in #B1 which is the original concern (see ref #22) for this med |
| 34 | 3/14/14; 1015 | Enter patient allergy to *Rocephin* with rash presentation | | **Create new concern** for *Rocephin* allergy #B5 | B5 | Allergies are concerns of themselves, so a new concern (the allergy - #B5) is created in this event. In this case the same observation event is <u>recorded in both</u> the active problem "Likely Drug Reaction" (#B4) |

| Clinical Event | | | | Concern | | |
|---|---|---|---|---|---|---|
| Ref | Date | Description | | Action | Concern No. | Comments |
| | | | | | | and the allergy "Rocephin" (#B5). |
| 35 | 3/14/14; 1030 | SOAP Assessment: Diabetes is currently uncontrolled | | **Add event** to concern #B3 that states that diabetes is presently uncontrolled | B3 | Need to revise the name of #B3 from *controlled* (see ref 26) to *uncontrolled* |
| 36 | 3/14/14; 1030 | Enter order to increase the dose of the med *Lantus* | | **Add event** to #B3 for change in *Lantus* dosing | B3 | |
| 37 | 3/14/14; 1030 | SOAP Assessment: pneumonia, likely pneumococcal, is improving | | **Add naming assessment event** to #B1 that indicates that the pneumonia is improving | B1 | Also involves a **concern name revision** to *likely pneumococcal pneumonia* |
| 38 | 3/14/14; 1030 | Place order for *Levaquin* | | **Add order event** to #B1 for the med Levaquin | B1 | Adding Levaquin to treat pneumonia |
| 39 | 3/15/14; 1115 | Record discharge diagnosis of *pneumococcal pneumonia* | | **Add naming assessment event** to concern #B1 to *pneumococcal pneumonia* | B1 | The renaming of #B1 is needed because ref 38 shows original name was "*likely ...*". This event reference need to remain static regardless of future name changes. |
| 40 | 3/15/14; 1115 | Record discharge diagnosis of *probable asthma* | | **Revise the name for concern** #B2 to *probable asthma* | B2 | The renaming of #B2 is needed because ref 35 shows original name was asthma, but hospital stay did <u>not</u> explore/resolve this concern. This event reference need to remain static regardless of future name changes. |
| 41 | 3/15/14; 1115 | Record discharge diagnosis of *diabetes type 1* | | **Revise the name for concern** #B3 to <u>remove</u> *uncontrolled* | B3 | Introduction of Lantus (ref 35) brought diabetes back under control |
| 42 | 3/15/14; 1115 | Record discharge prescription for medication Levaquin | | **Add prescription event** for medication Levaquin | B3 | Patient will need to fill this order post-discharge at a retail pharmacy |
| 43 | 3/15/14; 1115 | Final discharge order as | | **Final discharge order as concern** | B1 | The condition (pneumonia) is still |

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| Clinical Event | | | | Concern | | |
| --- | --- | --- | --- | --- | --- | --- |
| Ref | Date | Description | | Action | Concern No. | Comments |
| | | pneumonia condition is resolved | | **of pneumonia requiring hospitalization has resolved. Add discharge event** to pneumonia concern (#B1) as attending's concern has resolved. | | active, but the concern from the hospitals perspective is resolved. |

The ambulatory system now receives electronic summary of ED and hospital stay documentation with concern tracking identifications.

Table 4.3
**System A: Original Ambulatory (PCP) Office System –
Encounters *after* the ED and Impatient Stay**

| Clinical Event | | | | Concern | | |
| --- | --- | --- | --- | --- | --- | --- |
| Ref | Date | Description | | Action | Concern No. | Comments |
| 44 | 3/20/14; 0940 | Discharge Notice from Hospital is examined | | **Merge hospital concern** #B1 (Pneumonia) to existing PCP concern #A2 *(pneumonia))* | A2 | PCP concern #A2 now includes the event history of the inpatient care (procedure, meds, etc.) re the pneumonia care |
| 45 | 3/20/14; 0950 | Discharge notice from hospital is examined | | **Merge hospital concern** #B2 (diabetes) to PCP existing concern #A1 *(diabetes)* | A1 | Like event #40, this will pick up all the related events at the hospital re the diabetes care |
| 46 | 3/20/14; 0930 | Discharge notice from hospital is examined | | **Create new PCP concern** #A5 (*probable asthma*) from hospital concern #B5 (*probable asthma*) | A4 | This assures that the PCP's examination today will include an exploration of the recent finding of asthma at the hospital. |
| 47 | 3/20/14; 1025 | Patient presents at the PCP office for hospital follow-up visit | | | | |

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| Clinical Event | | | | Concern | | |
|---|---|---|---|---|---|---|
| Ref | Date | Description | | Action | Concern No. | Comments |
| 48 | 3/20/14; 1030 | Encounter note: Exam reveals wheezing | | **Add assessment event** to *asthma* concern #A4 | A4 | |
| 49 | 3/20/14; 1025 | Procedure – perform spirometry test | | **Add procedure event** to *asthma* concern | A5 | Result value(s) should be part of event entry |
| 50 | 3/20/14; 1030 | Encounter note: Exam reveals wheezing | | **Add assessment event** to *asthma* concern #A4 | A4 | |
| 51 | 3/20/14; 1035 | Encounter note with assessment-observation info: pneumonia | | **Add assessment event** to *pneumonia* concern #A2 - 'improving' | A2 | This entry is recording the fact that pneumonia is still present. This is important to decision support and episode-oriented quality reporting. |
| 52 | 3/20/14; 1050 | Encounter note: assessment of asthma | | **Add naming assessment event** to #A4 *asthma, confirmed* | A4 | This entry is based on the spirometry results. This is important to decision support and quality reporting |
| 53 | 4/20/14; 1545 | Patient presents at the PCP office for 2nd hospital follow-up visit | | | | |
| 54 | 4/20/14; 1600 | Encounter note with assessment-pneumonia resolved | | **Add this assessment event** to Concern #A2: *pneumonia* changed to inactive | A2 | The time when the condition of pneumonia actually resolved in the patient is not 4/20 @ 4pm. This time is unknown. All that the computer knows is that the PCP has stopped being concerned (stopped following) 4/20 @ 4pm. |

This is a simpler example than exists in real patients where the history of events can be hard to follow because problems/concerns are dynamic and the thinking about the concern evolves over time. But the benefits of a HealthConcern system are evident because a history can now be constructed for each concern separately. For example, if the PCP is interested in what has been happening with the concern in his EMR labeled "Diabetes, Type 1", and how/why the Lantus was increased in the hospital – he can easily see the history associated with concern #A1 (Ref #36).

# 5  HealthConcern Domain Analysis Model

The following is a UML analysis model representing the use cases and information requirements for the HealthConcern concept.

## 5.1  Actor Roles



Not only clinicians but also patients and their proxies may express concerns. This is clearest in the PHR context.
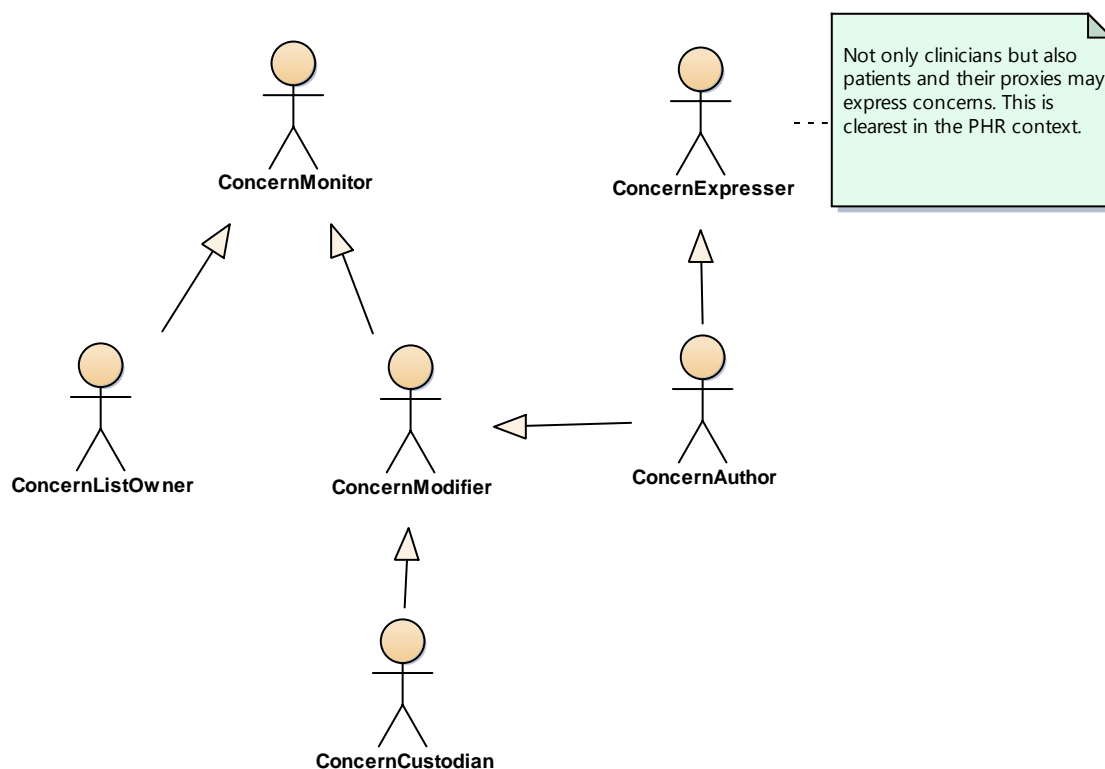
Figure 2

HealthConcern Class Actors

## 5.2  HealthConcern Use Case Diagram

The ConcernExpresser will typically be a healthcare provider, but may in some patient-centric systems be a patient or patient proxy or someone else if the patient disputes the Concern. The ConcernAuthor may create, modify, or view concerns. Only one specific paradigm for viewing a concern is shown; others may be suggested. Any particular individual may play several roles.

### 5.2.1 ConcernExpresser

A patient, caregiver, family member, or other person who expresses a concern.

### 5.2.2 ConcernAuthor

A person who creates the HealthConcern in an HIT system.

### 5.2.3 ConcernCustodian

A provider, patient, family member, or other person who is responsible for the maintenance of a Health Concern record. A custodian is a specialization of modifier.

### 5.2.4 ConcernModifier

A person who modifies a concern but may not necessarily monitor the concern. For example, an x-ray technician who adds results or someone doing an administrative task who does not monitor the concern.

### 5.2.5 ConcernMonitor

A person who monitors a concern over time, but does not make changes, itself.

### 5.2.6 ConcernListOwner

A person or system responsible for compiling and maintaining a concern list. The list may contain many concerns which may be from multiple concernCustodians.

### 5.2.7 Patient

The individual who is the subject of the care provision.

## 5.3 Use Cases

This is a list of Use Cases for the HealthConcern Model.

### 5.3.1 Add Event

Associate an event with a HealthConcern.

### 5.3.2 Associate Events

Assert that two HealthConcern events have a relationship (e.g., a diagnosis and a glucose observation).

### 5.3.3 Associate Concern

Associate an existing HealthConcern with another HealthConcern.

### 5.3.4 Disassociate Concern

Remove an associated HealthConcern from a HealthConcern.

### 5.3.5 Dissociate Events

Remove an asserted relationship between two events.

### 5.3.6 Identify HealthConcern

Designate an identifying event for a HealthConcern.

### 5.3.7 Monitor HealthConcern

View information about a HealthConcern at points in time determined by a specific care plan or by clinical protocol (e.g., "weekly", "when the patient comes in").

### 5.3.8 Promote Event

Create a HealthConcern out of an existing component fact. This is a specialization of Record HealthConcern.

### 5.3.9 Record HealthConcern

Create a new HealthConcern, whether by identifying an existing component fact as a concern or creating a component fact that is itself a concern.

### 5.3.10 Remove Event

Disassociate an event from a HealthConcern.

### 5.3.11 Supersede Event

Replace an existing event with one that corrects or refines it.

### 5.3.12 Update HealthConcern

Change the information constituting an existing HealthConcern.

### 5.3.13 View HealthConcern

View the information about a HealthConcern.

### 5.3.14 ManageList

Collect concerns into lists and maintain membership by adding and removing concerns as appropriate, adding or removing documents related to the list or other administrative tasks.

### 5.3.15 Reconcile Concerns

Compare concerns of record with concerns listed by some other resource, determine relative currency and accuracy of information, and merge, add, resolve, or supersede concerns as appropriate.

This may involve a variety of information architectures, including time series, causal network, recent events, etc.

## 5.4 HealthConcern Class Diagram

This diagram represents the HealthConcern aggregation and its relationships to other classes. The HealthConcern domain is placed in the context of the CarePlan in order to illustrate the close relationship between the two.



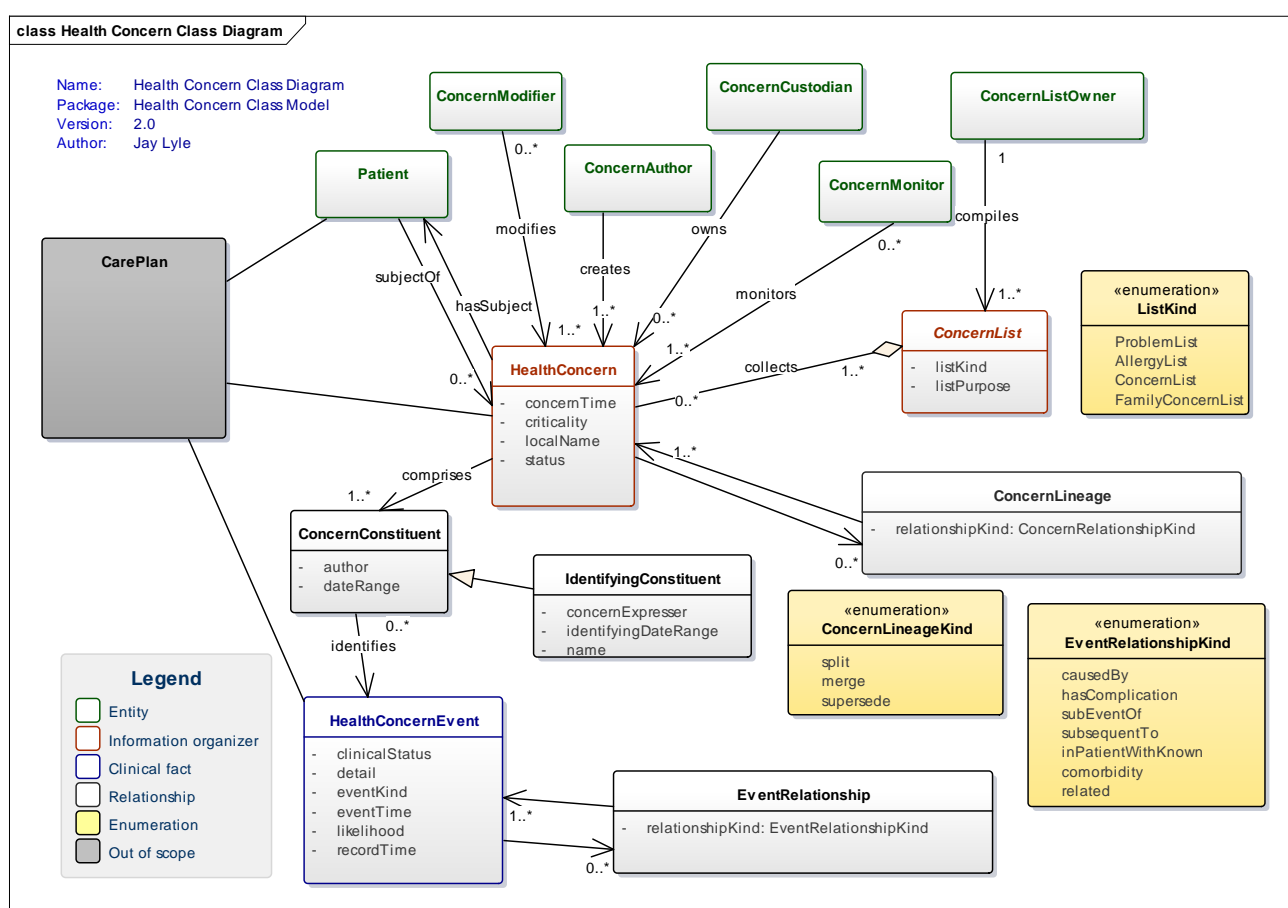Figure 4 HealthConcern Class Diagram

### 5.4.1 HealthConcern

A HealthConcern is a health related matter that is of interest, importance or worry to someone, who may be the patient, patient's family or patient's health care provider. This matter may change names or have added information over time, called HealthConcernEvents, but stays a matter of concern to the expresser and/or the health care provider.

HealthConcern properties may be derived from the identifying constituent (e.g., current diagnosis).

Usage note: A HealthConcern is typically a variation from a desired health status or a condition that may harm the patient or place the patient at risk for harm, and may need management or attention, The HealthConcern may include biological, social, financial, or other issues.

A pregnancy is an example of a condition which may or may not be desired in and of itself, but at minimum requires management because it places special risks on the patient and fetus that could create an undesirable outcome if not properly managed.

HealthConcerns span time and by their nature evolve over time. As recorded by the system, Concerns are represented as containing discrete, related observation events. Together these events form a history of the concern which approximates the clinicians' understanding of a pathologic processes or risk in the patient (separate from other processes of the patient which may also be evolving, but at different course, and at different rate, or of different importance). HealthConcern records not only a point in time observation, but a series, and therefore a concern can be useful in the prediction of future events and management plans (i.e., a diagnostic order is not needed because it was already performed recently, or more urgent action is required because of the speed of decline in function).

The condition as noted at a point in time may prompt action(s). These may be specified order(s), a set of complex management strategies/plans, a decision to follow up at a later point in time to observe for changes or a decision to do nothing. A concern may also imply one or more explicitly stated (prioritized) goals or desired outcomes for a future point in time indicating a target that can be measured at that future time point (i.e. a goal met/partially met/not met). However, these relationships are in the scope of the Care Plan domain, not the Health Concern domain.

*Attributes*

| Name | Notes |
|------|-------|
| concernTime | The time the concern was expressed and recorded (start & end or duration) during which the concern is recognized. This is analogous to V3 Act.effectiveTime . |
| criticality | The degree of injury/illness and risk to patients. |
| localname | A name assigned for ease of reference. |
| status | The state of the concern (e.g., Active, Inactive, Erroneous). |

### 5.4.2  HealthConcernEvent

A fact that may be of concern, or that may be related to a concern, which is added to the HealthConcern.

A HealthConcernEvent will typically be an observation of a medical condition (such as diabetes or hypertension) at a point in time, but could be a risk, a complaint or clinical observation that has not

yet been diagnosed, a procedure (e.g., a coronary bypass graft operation), or any other situation that has been designated as an issue that requires attention, whether for treatment or monitoring for possible indication of treatment. This event is added to the HealthConcern as part of the list of facts and observations.

HealthConcernEvent may have many attributes that will be useful in filtering and displaying a concern to a clinician.

*Attributes*

| Name | Notes |
|------|-------|
| description | Description of the event. |
| clinicalStatus | For conditions, the state of the condition (e.g., new, worsening, resolved), for a risk (e.g., increasing, decreasing, resolved). Other events may have states or status as well. |
| detail | The assessed value of a property.<br><br>This property is used for measurements and other question & answer form facts. Assertions of unary concepts use only the "component kind" property. |
| eventKind | The classification of the HealthConcernEvent (e.g., a diagnosis, complaint, symptom or EncounterNote-Assessment, Registration Complaint, EncounterNote-Exam, etc.). In V3 terms, this is equivalent to Act.code. |
| eventTime | The effective clinical time at which the phenomenon occurs. |
| likelihood | Probability that a fact or situation is or may be real.<br><br>This property may be split into epistemological values (suspected, confirmed) and ontological values (at risk, goal, present). |
| recordTime | Time that the event was entered into the EHR. |

### 5.4.3 IdentifyingConstituent

An Identifying Constituent is the focal event of the concern, typically used to name the concern. A HealthConcern may have many events, but only one of them for example, the latest diagnosis, identifies the current understanding of what the concern is at any given time. A HealthConcern may have more than one name over time, and a clinician should be able to review the history of name changes. Different healthcare providers may assign different concern identifiers based on their need.

| Name | Notes |
|---|---|
| concernExpresser | A patient, clinician, caregiver, family member, or other person who expresses a HealthConcern, or who identifies a new name or focal concept for an existing concern.<br><br>Note: different persons may identify different ConcernIdentifyingEvents for a concern at the same time. This should eventuate in those who disagree recognizing that there is disagreement and taking steps to ensure both parties are in full command of the facts. |
| identifyingDateRange | The time interval over which the constituent identifies the concern. This may not be the same as the interval of association; e.g., an identifying constituent may be superseded by a more informed diagnosis, but remain part of the concern record. |
| Name | The name being assigned to the concern. |

### 5.4.4  CarePlan

A set of goals and planned interventions designed to treat a particular HealthConcern. Care Plan is not part of the HealthConcern domain, but it is closely related, so it is shown here for reference.

Forward-looking actions (e.g., noting that a concern should be re-evaluated in 6 months and making an appointment to do so) are part of the Care Plan domain and are not elaborated here, though the Concern concept does support the association of such actions with a concern via the plan and goal.

### 5.4.5  Patient

The individual who is the subject of the care provision .

### 5.4.6  ConcernAuthor

A patient, clinician, caregiver, family member, or other person who identifies a Health Concern in a HIT system. Note that different persons may identify different focal components for a concern at the same time. This should eventuate in those who disagree recognizing that there is disagreement and taking steps to ensure all parties are in full command of the facts.

### 5.4.7  ConcernCustodian

The person or organization responsible for maintenance of the concern, whether by direct or delegated action. Custodianship confers authorization to modify a concern. It may be assumed by the author or assigned by delegation, rule, or any other mechanism. These mechanisms are a matter of institutional policy.

### 5.4.8  ConcernConstituent

A relationship associating a Concern with an event (diagnosis, risk, observation) – including the event that is the focus of the concern (typically but not necessarily a diagnosis).

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| Name | Notes |
|------|-------|
| dateRange | The range of time over which the constituent is associated with the Concern. |
| author | The person responsible for associating the constituent event with the Concern. |

### 5.4.9 ConcernMonitor

A person or device that reads the concern periodically.

### 5.4.10 ConcernModifier

A person with the authority to modify the Concern.

### 5.4.11 ConcernList

A collection of concerns identified by a person or system for a purpose. Usually, the purpose is to produce output, such as a display or a report with which a care provider can perform tasks within the care plan.

| Name | Notes |
|------|-------|
| listPurpose | A description of the reason the list was created; e.g., personal list for use of a specific provider; list created for referral to ophthalmologist; comprehensive list of all active concerns in system; comprehensive list of all concerns in system; list of concerns identified by patient or family member; etc. |
| listKind | A functional classification of a list. listKind is more generic than listPurpose, which may be tailored to a specific context. |

### 5.4.12 ListKind

Classification of lists. This represents a possible set of ListKind objects and is not meant to be exhaustive.

| Name | Notes |
|------|-------|
| ProblemList | A list of problems a patient has, from the perspective of the ListOwner, typically used for monitoring conditions and managing comorbidities. |
| AllergyList | Concerns based on risk of adverse reaction to substances or, in some cases, radiation. |
| ConcernList | Concerns of any kind. |

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| Name | Notes |
|------|-------|
| FamilyConcernList | Concerns expressed by patients or their proxies but not necessarily shared by clinicians. |

## 5.4.13 ListOwner

A person or system that compiles a list of concerns based on some set of criteria.

## 5.4.14 ConcernRelationship

Relationships among HealthConcerns.

## 5.4.15 ConcernRelationshipKind

Kinds of relationships among HealthConcerns.

*Attributes*

| Name | Notes |
|------|-------|
| causedBy | The target concern is deemed to precipitate the source concern. |
| hasComplication | The source concern is problematized by another that, e.g., worsens it or contraindicates a treatment. |
| evidenceFor | The source concern provides evidence for another concern. |
| subconcernOf | The source concern is a specific subset of the target (e.g., a patient may have two cancer diagnoses, both subconcerns of a general cancer concern). |
| subsequentTo | The source concern occurred after the target concern. |
| inPatientWithKnown /comorbidity | The source concern occurs in a patient with the confirmed target concern. |
| relatedConcern | The concerns have an unspecified relationship. |

## 5.4.16 ConcernLineageKind

Ways concerns may change into each other

| Name | Notes |
|------|-------|
| merge | Multiple source concerns are deemed to be a single target concern. |
| split | The source concern is deemed to be multiple target concerns. |
| supersede | The source concern supersedes the target concern. |

## 5.5  HealthConcern Example

This section illustrates a HealthConcern and the events that are created as the concern evolves over time.
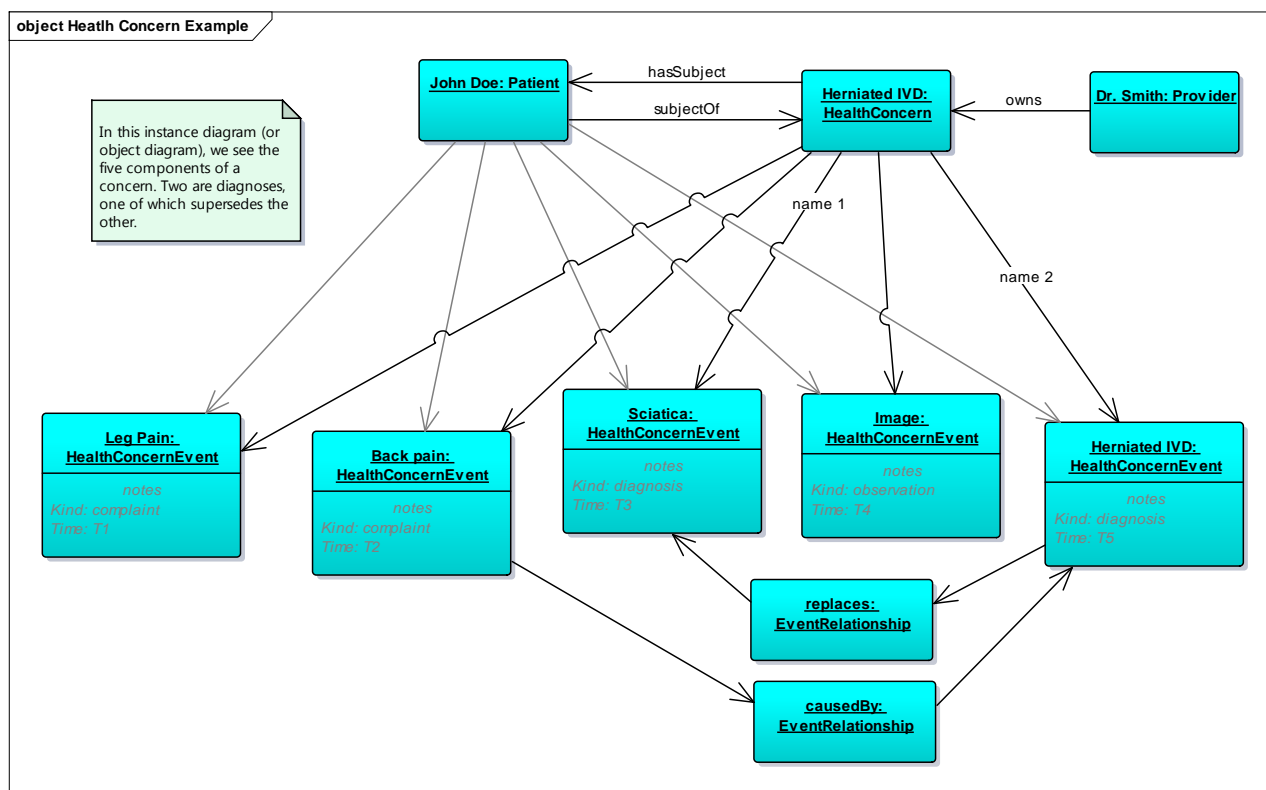


Figure 5 HealthConcern Example

Several related facts are recorded about a patient over time. At one point, Dr. Smith identifies Sciatica as an IdentifyingConstituent that creates a new HealthConcern and uses the HealthConcern to group the leg and back pain complaints. Dr. Smith monitors the concern. He then orders an image, and on review, he revises the concern identification to Herniated IVD, indicating that the back pain is caused by that diagnosis.

# 6 APPENDIX I – Additional Clinical Scenarios

These scenarios were developed to illustrate the varied nature of how a health concern might be presented to the health care community.

## 6.1 Clinical Scenario 1 - Health Concern Observations

This scenario illustrates related problems and a hierarchical structure of the concerns.

**GP Encounter: First visit/consultation:**

A 48-year-old male patient was seen by a primary care provider (PCP) on 20 June 2012.He presented to the PCP with complaints of lethargy, polydipsia, polyuria, difficulty in concentration, and recent weight loss. Patient has no family history of Type 1 or Type 2 Diabetes Mellitus.

*Clinical observation*:

Spot blood glucose level revealed an elevated reading.

BMI = 30.4 (obese).

GP made a provisional diagnosis of type 2 diabetes mellitus and requested additional tests.

**GP Encounter: Second visit/consultation**:

Patient was seen again by his GP on 25 June to discuss the test results. The GP made a diagnosis of Type 2 diabetes.

**Hospital Encounter**:

On 30 June, patient presented at the ED of his local hospital with the following presenting signs and symptoms: fever, productive cough, dyspnea for 3 days, severe thirst, muscle weakness and increasing lethargy since onset of respiratory symptoms, warm dry skin, dry oral mucosa, blurred vision and mental confusion.

The treating physician diagnosed the patient to be suffering from lobar pneumonia and Hyperosmolar Hyperglycemic Nonketotic Syndrome (HHNS). The patient was treated in the hospital and discharged back to the care of his PCP. An electronic discharge summary was sent to the PCP.

*HealthConcerns and Tracking*

The PCP determined that the patient's health conditions/issues (including actual complications and assessed prognosis) identified since the first visit are of significant concern and should be tracked continuously.

The HealthConcern Tracker application of the PCP medical record system continues to track the patient's diabetes problem and related issues:

- Presenting signs, symptoms, clinical evaluation, problems, diagnoses identified at each encounter/visit.
- Outcomes of interventions.

- Risks for complications: cardiovascular, neurological, renal, ophthalmic, etc.
- Prognosis of the condition(s).

## 6.2 Clinical Scenario 2 – HealthConcern Observations and Tracking: Head Trauma

This scenario illustrates the tracking and monitoring principle.

**HealthConcern Observations:**
A 57-year-old female patient was brought into the Emergency Department of the local hospital suffering from concussion. The car she was travelling in collided sideways with a light post. Her head hit the B pillar of the car. Her chief complaints/presenting signs/symptoms include: severe headache; dizziness; nausea; loss of consciousness (LOC) for 7-8 minutes prior to arrival at ED.

She was hospitalized and then discharged to the care of her primary care physician (PCP). The hospital discharge summary contains a discharge diagnosis: concussion.

Three weeks later, the patient presents at her PCP office with a number of complaints which are documented by the PCP in the patient's electronic medical record (EMR).

HealthConcern observation: presenting signs and symptoms:

- Fatigue; insomnia; increased sensitivity to noise and light.
- Cognitive problems: deteriorated memory, concentration and thought processes.

The PCP advises patient to take adequate rest and prescribes medication for post-traumatic injury and chronic headache; The PCP makes a diagnosis: post traumatic injury/disorder; post-concussion syndrome. The PCP organizes follow up visits for the patient to continue monitor and manage the condition. The follow-up visits continue until 4 months later the patient presents with a set of new complaints.

Health/Problem concern observation: presenting symptoms/problems

- Irritability; anxiety; mood changes; depression mood.
- The PCP prescribes anti-depressant and refers patient for psychotherapy.

**HealthConcern Tracking**
The PCP discusses with the patient the importance of tracking the health/problem concern observations to monitor the clinical status and progress in relation to treatment/management. The following are tracked under post-concussion syndrome HealthConcern Tracker:

- Presenting signs, symptoms, and clinical evaluation at each encounter/visit.
- Medication and therapy treatment, patient compliance and outcomes.
- Assessment of the condition including risks of organic brain lesions.

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## 6.3  Clinical Scenario 3 – Nutrition Focus

This scenario illustrates a scenario with multiple concerns.

A 50-Year-Old Man with Metabolic Syndrome:

**Background**

The patient works in maintenance for the apartment building where he lives. He has been overweight since childhood and has been unable to lose weight despite many attempts. Several fad diets have resulted in as much as a 15-lb weight loss, but eventually he regains all the lost weight and rebounds past his baseline weight, becoming morbidly obese. The patient does not exercise except for walking associated with his job. His family has expressed concern about his risk of developing type 2 diabetes mellitus or heart disease, and they have convinced him to seek medical consultation. The patient states he has not seen a physician in 2 years, and he has not adhered to his cholesterol-lowering therapy because of the cost of the drug.

**HealthConcerns:**

1. Morbid Obesity (provider).
2. Risks;
    a. Type 2 Diabetes (provider and family).
    b. Stroke (provider).
    c. Myocardial Infarction (provider and family).
    d. Cost of medications (family).

# 7   APPENDIX II – Patient Journey Scenarios

The following scenarios describe different patient journeys and how the HealthConcern concept is related to structuring information between care providers and their electronic health care systems.

## 7.1   Patient Journey Scenario 1 - Abdominal Pain

This scenario describes the flow of a patient through various health institutions in which the diagnosis changes over time.

Ricardo D. 16 years old has pain in the abdomen. He cannot digest his meals and vomits all the food he eats. Ricardo complains about his ache to his mother.
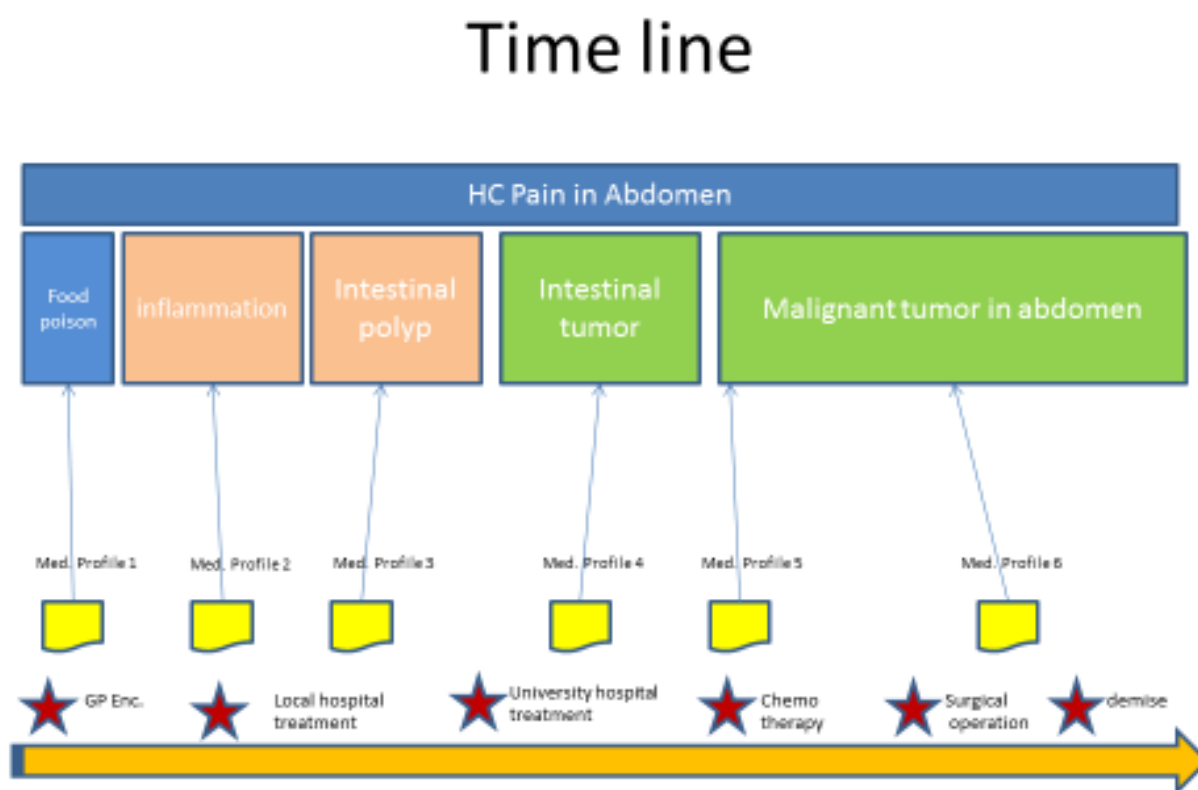


Figure 7 - Longitudinal view health concerns

The first diagnosis of the GP is food poisoning. Medication is given for diarrhea and food poisoning. The vomiting and pain still remain after 1 week. The GP suspects some inflammation in the abdomen. New medication is given and meanwhile Ricardo is referred to the general hospital.

If health concerns were tracked across the GP visits/encounters:

- The initial diagnosis (abdominal pain for investigations or food poisoning) will be flagged in the GP EMR as health concerns and linked to supporting data such as presenting complaints, physical examination findings (signs, symptoms) and treatment data.
- The changed diagnosis (e.g. e.g., inflammatory bowel disease) would also be flagged and linked to support data identified during the second visit.
- The HealthConcern data from both visits will be linked and can then be tracked.
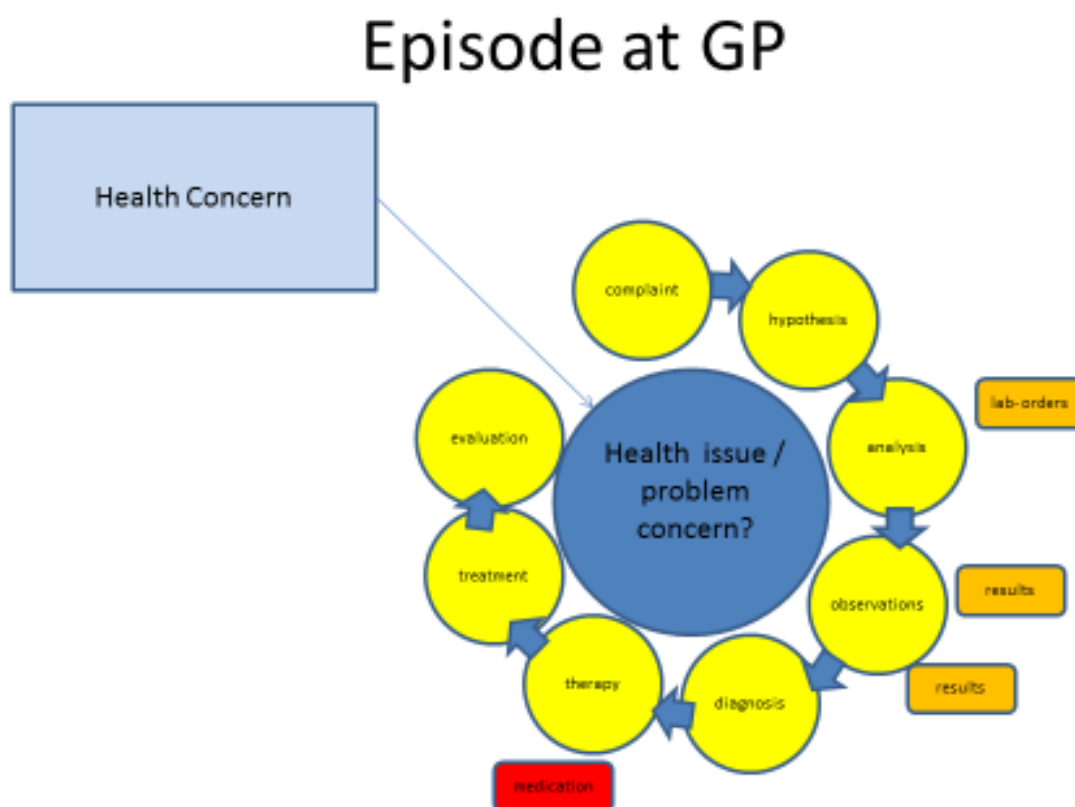


Figure 8 6 Events and flow primary care

The general hospital investigates a possible inflammation, but does not find the cause. The hypothesis changes to a possible polyp in the intestines. Meanwhile Ricardo is severely weakened and is put on tube feeding. The scans are showing no results. One month has passed since the initial complaints.
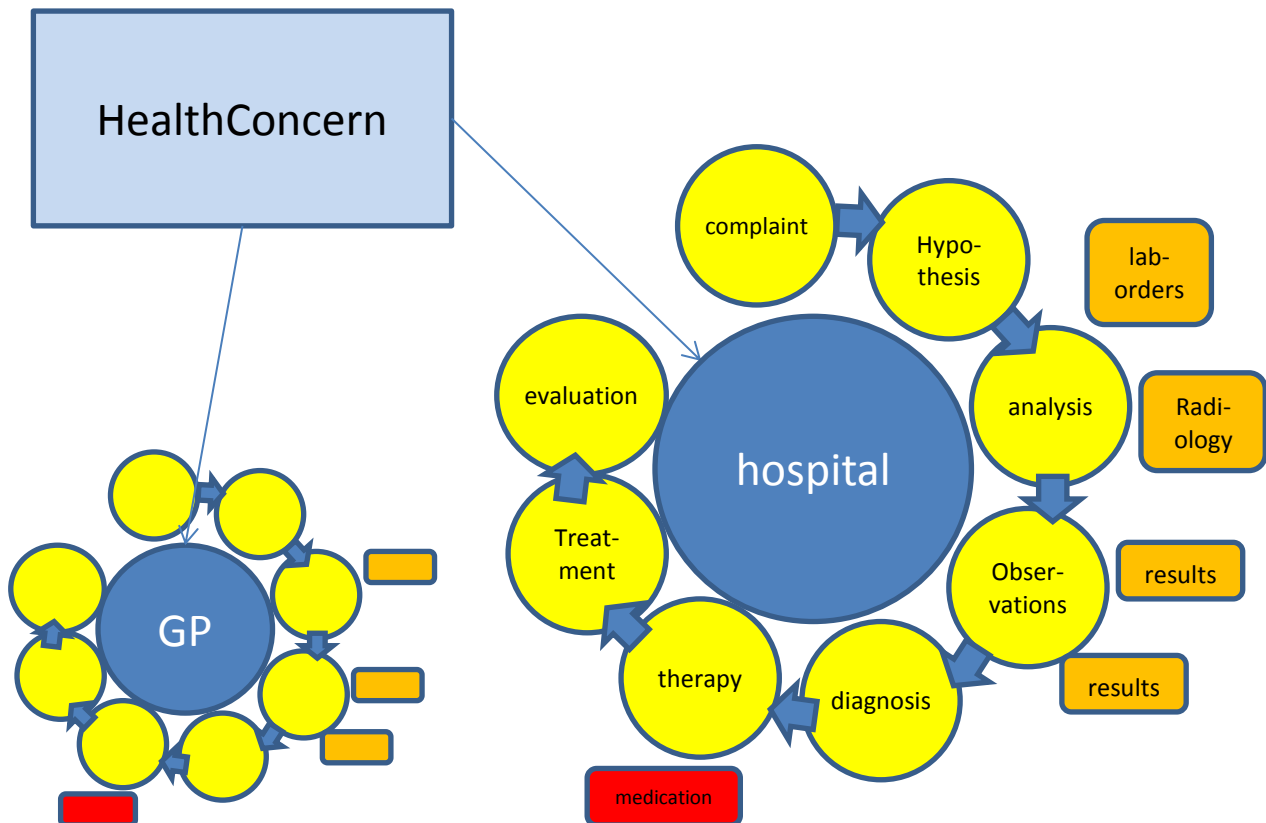
Figure 9 - Events and flow general hospital, while reflecting back at concerns within the primary care

The parents have no confidence in the general hospital and consult their GP. The GP updates his records and concerns. The GP advises them to consult the university hospital and helps them with the referral. The medical records with the suspected concerns are submitted to the university hospital. The physician suspects an intestinal tumor, but the scans show no abnormal results. Finally, after 3 months they find the cause of the problems: a malignant tumor in the abdomen.

Figure 10 - Events and flow in University hospital, while reflecting back at concerns in the past

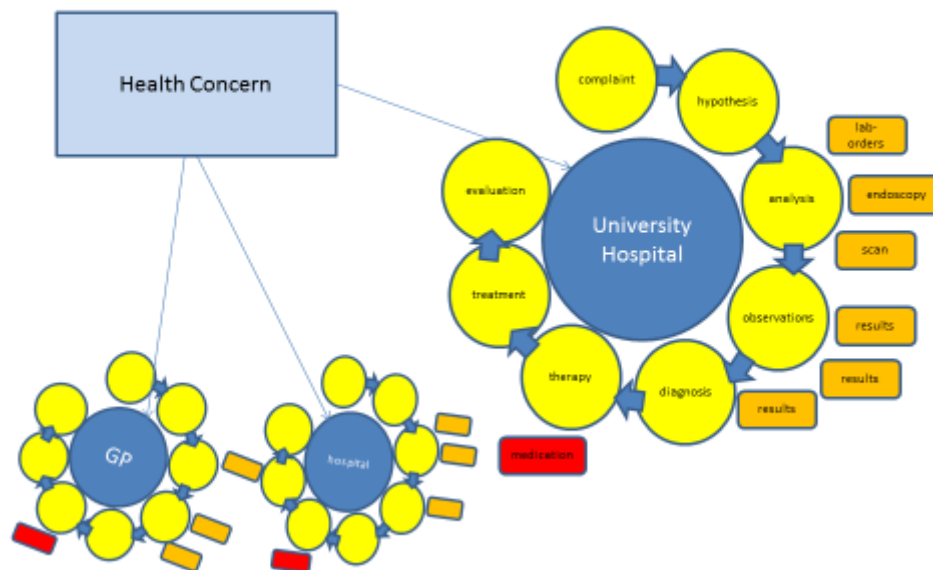Ricardo is being treated with chemo therapy, but the therapy is not successful. The physician decides for surgery to remove the malignant tumor. The surgery showed that the cancer has spread over a large part of the abdomen. The physician removes as much malignant tissue, but concludes that the situation is too grave to be saved. Ricardo is brought home and the doctors give him 2 months to live. A transfer of care document is sent to the GP to support Ricardo with the palliative care. The GP updates his records and concerns. Ricardo celebrates his last birthday with his family and friends. Forty-five days later he passes away.

**HealthConcern Tracking – the chronological events**:

- The starting HealthConcern is *pain in abdomen*. This is the view from the patient and is retrospective from the time the condition is flagged as a health concern and when a decision to track the health concern is made.
- The GP thinks it is food poisoning. The *problem concern* would then be identified or assigned as *food poisoning*.
- The treating physician at general hospital suspects at first an inflammation of the abdomen. The *concern* could be changed to abdominal *inflammation or inflammatory bowel disease*.
- After investigation the treating physician revised their findings and suspects an intestinal polyp in the large intestine. The problem concern would then be changed to *intestinal polyp*.
- The university hospital physician reviewed the results and are convinced that the problem is an intestinal tumor. The problem concern is then *intestinal tumor.*
- An endoscopic procedure identifies the location of the tumor and the histo-pathology test result leads problem concern to be set to *malignant tumor in upper region of abdomen.*
- The overarching health concern (pain in abdomen) is the view from a patient. The patient does not have a system to enter this input.

- Most probably the care providers will define the problems like inflammation as their health concerns.

## 7.2 Structured Primary Care Approach

This scenario is to illustrate how Primary Care providers in the Netherlands organize their information.

The General Practitioners in the Netherlands work according to a highly structured method which is set as guideline for the practitioners for working with their EHR. IT systems for the GP's are certified against the reference information model of the GP association. Using the same reference information model makes access to an EHR more transparent and transfer from one system to another simpler.

The structure of the information model reflects a problem-oriented approach. This is called the Problem Oriented Registration (POR). The characteristics of this POR is very much similar to the HealthConcern topic. Another word frequently used in this context is the Episode Oriented Registration. Health concerns may contain an attention flag. This flag can be seen as a reminder even if an episode has been terminated.

The following outlines a potential use case.

A patient visits his GP because he is coughing and has trouble breathing and coughing. The GP looks at the patient's medical record, which displays episodes of concerns. He has a long medical history and on the active health concerns are displayed on the top part of the screen, while health concerns that are no longer open may be displayed under the category: "terminated episodes".

The active health concerns are gastritis, problems with work, malaria prophylaxis and tuberculosis (TBC). The heading of the HealthConcern contains a description of the problem, and also an International Classification of Primary Care (ICPC) code (International Classification of Primary Care). The patient has been on holiday in Tanzania and has been coughing since he returned. He has been referred to the pneumonologist from the hospital where he has been diagnosed for tuberculosis and has been treated with Rifinah.

| | Patient | Address | Birthdate | Profession |
|---|---|---|---|---|
| | Mr. John Doe | 327 Whitmore road, Kilkenny, Ireland | 28-06-1949 | Administrator |
| | Episode List | | | |
| < | Open episodes | | Care plans | |
| | D87 | Gastritis | Medication | > |
| | Z05 | Job related problems | Referrals | > |
| | A44 | Malaria profylaxe | Correspondence | > |
| | R70 | Tuberculosis | | |
| | | | | |
| > | Closed episodes | | | |
| | | | | |
| < | Overview Episode Items | Summary activity | ICPC | Date |
| | Dr. Pil | Rx/ Rifinah tablets | TBC- R70 | 24-01-2014 |
| | Dr. Pil | C: Influenze vaccination | TBC-R70 | 22-12-2013 |
| | Dr. Pil | Pneumologist: Progressing well, Refinah | TBC- R70 | 18-11-2013 |
| | Dr. Pil | Rx/ Rifinah tablets | TBC-R70 | 18-11-2013 |
| | Dr. Green | Reoccurrence Gastritis, probably medication | Gas-D87 | 11-11-2013 |
| | Dr. Green | Rx/Omeprazole 20 mg, Gastritis | Gas-D87 | 11-11-2013 |
| | Dr. Pil | Diag. Pneumologist, Tuberculosis (TBC) not open, 6-month cure | TBC-R70 | 06-11-2013 |
| | Dr. Pil | Rx/ INH 200 mg 90 | TBC-R70 | 06-11-2013 |
| | Dr. Pil | Rx/ Rifampicin 300 | TBC-R70 | 06-11-2013 |
| | Dr. Pil | X-thorax: H left top, Cave M.Koch: coughing | Cough-R05 | 28-10-2013 |
| | Dr. Pil | Cough sinds visit Tanzania | Cough-R05 | 26-10-2013 |
| | Dr. Pil | Referral Dr. Lung pneumologist coughing | Cough-R05 | 26-10-2013 |

The consult is also registered under this episode. To speed up the analysis the PCP has written an order to the radiologist of the X-ray Diagnostic Centre to take an X-ray of the patients' lungs. The clinician instructs the X-ray center to include the health concern reference number in the identity of the results.

The PCP's diagnosis was this was not an open Tuberculosis (TBC) and a six-month cure should be sufficient. In November, the patient complained about gastritis. This could be caused by the Refinah medication and therefore the PCP decided to adjust the medication and change to a different brand.

Although the gastritis might be linked to the episode of TBC, it was decided to register it under a separate concern identifier.

The last note from the pulmonologist is from November 2013 from the regular check-up. It showed that the situation of TBC was under control.

The cold and windy winter months were now heading and it was decided to give the patient an influenza vaccine. The main reason is a TBC diagnosis and influenza could be disastrous. The vaccine is therefore also noted under the episode of TBC.

The fact that he has had TBC has already been flagged since his first encounter with TBC.

# 8   APPENDIX III – Comparison of Use of "Health Concern" Concept

| Concept | HL7 Health Concern DAM | HL7 C-CDA R2.1 | ISO/DIS 13940 |
|---|---|---|---|
| **Health Concern Definition** | A Health Concern is a health related matter that is of interest, importance or worry to someone. This may be the patient, the patient's family or a patient's health care provider. | Note 1– there is a Health Concern Section containing a Health Concern Act – *The Health Concern Act* is a wrapper for a single health concern which may be derived from a variety of sources within an EHR (such as Problem List, Family History, Social History, Social Worker Note, etc.). | ISO "Contsys" defines "Health Issue" (Section 6.1.) as: Issue related to the health of a subject of care, as identified and labelled by a specific health care actor. NOTE 1 According to this definition, a health issue can correspond to a health problem, a disease, an illness or another kind of health condition. In addition a health issue may represent e.g. a request for a procedure (therapeutic or preventive) by the subject of care or another health care actor etc. NOTE 2 A health issue is given a label, which may be a health condition expressed as a diagnosis, a problem or another topic. NOTE 3 While a health issue may be collective, such as an epidemic, some nosocomial infections etc., in the perspective of personal health and personal health data management, only individual subjects of care are to be considered. NOTE 4 From the EHR point of view, a health issue can define a folder of a Problem-Orientated Medical Record (POMR). This folder corresponds to and gathers all data and information elements regarding that health issue NOTE: The patient is not recognized in the ISO document as a possible health care actor who identifies a health issue. |

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| Concept | HL7 Health Concern DAM | HL7 C-CDA R2.1 | ISO/DIS 13940 |
|---|---|---|---|
| **Health Concern Event** | *Health Concern Event* A fact that may be of concern, or that may be related to a concern, which is added to the HealthConcern. A HealthConcernEvent will typically be an observation of a medical condition (such as diabetes or hypertension) at a point in time,, but could be a risk, a complaint or clinical observation that has not yet been diagnosed, a procedure (e.g., a coronary bypass graft operation), or any other situation that has been designated as an issue that requires attention, whether for treatment or monitoring for possible indication of treatment. This event is added to the HealthConcern as part of the list of facts and observations. HealthConcernEvent may have many attributes that will be useful in filtering and displaying a concern to a clinician. | A *Health Concern Act* is used to track non-optimal physical or psychological situations drawing the patient to the health care system. These may be from the perspective of the care team or from the perspective of the patient. Contains over 30 entry level templates including problem concern act, problem observation, result observation, and functional status observation. Risk is documented in a separate template. | No equivalent concept. |

| Concept | HL7 Health Concern DAM | HL7 C-CDA R2.1 | ISO/DIS 13940 |
|---|---|---|---|
| **Health Concern Tracking** | Health Concern events are through "concern constituents" to concern events, expressed as issue(s), condition(s), problem(s), diagnosis/diagnoses, risk(s), barrier(s))<br><br>Tracking is done by monitoring the progress of the patient through these relationships.<br><br>Other related topics such as goal(s), preference(s) and intervention(s) [and their related observations/ evaluations] may also be linked to health concern(s) through the health concern tracking. | A C-CDA document is by definition a snapshot in time – the health concern act is not dynamic. Health concerns may have relationships. | "Health Issue Thread" (Section 6.2): defined association between *health issues* and/or *health issue threads*, as decided and labelled by one or several *health care actors*. |

| Concept | HL7 Health Concern DAM | HL7 C-CDA R2.1 | ISO/DIS 13940 |
|---|---|---|---|
| **Health Concern Risk** | A type of HealthConcernEvent where the Concern (and therefore planned action) is currently about a potential future state rather than an existing condition of the patient. | Risk concern act – It is a wrapper for a single risk concern which may be derived from a variety of sources within an EHR (such as Problem List, Family History, Social History, Social Worker Note, etc.). A Risk Concern Act represents a health concern that is a risk. A risk is a clinical or socioeconomic condition that the patient does not currently have, but the probability of developing that condition rises to the level of concern such that an intervention and/or monitoring is needed. | "Risk Condition" (Section 6.1.2.2.4): "*possible health condition representing an undesirable future health state*" |
| **Relationship to problem** | No equivalent concept. A problem is a health concern that someone has added to a problem list | The Problem section lists and describes all relevant clinical problems at the time the document is generated. At a minimum, all pertinent current and historical problems should be listed. Overall health status may be represented in this section. Entry level templates associated with the problem section include problem concern and health status observation. | No equivalent concept |

| Concept | HL7 Health Concern DAM | HL7 C-CDA R2.1 | ISO/DIS 13940 |
|---|---|---|---|
| **Relationship to Problem Concern Act** | The constituent event expresses the relationship between the health concern and the health concern events. The problem act is considered as a health concern event. (for example, a condition). The status of the act can be found in the health concern event. | The Problem Concern Act template reflects an ongoing concern on *behalf of the provider* that placed the concern on a patient's problem list. So long as the underlying condition is of concern to the provider (i.e., as long as the condition, whether active or resolved, is of ongoing concern and interest to the provider), the statusCode is "active". Only when the underlying condition is no longer of concern is the statusCode set to "completed". | No equivalent concept. |
| **Problem Observation** | An observation is also a health concern event. (see previous remark on events). | The problem observation template reflects a discrete observation about a patient's problem. Because it is a discrete observation, it will have a statusCode of "completed". The effectiveTime, also referred to as the "biologically relevant time" is the time at which the observation holds for the patient. For a provider seeing a patient in the clinic today, observing a history of heart attack that occurred five years ago, the effectiveTime is five years ago. | No equivalent concept. |