

Development of Clinical Information Models (CIM) to standardise clinical documentation in cancer care

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INTRODUCTION



Abstract

Clinical information models (CIMs), are formal specifications representing structured semantic clinical content to be implemented within electronic healthcare record (EHR) systems. By documenting clinical information in a formalised and structured way within EHR systems, ensures that information input is accurate, consistent and easily accessible to medical professions. Which in turn plays an important role in improving work efficiency, ensuring patient safety, better patient care and that the data captured is sustainable for secondary use in medical research. The implementation of CIM, can also replace or minimise excessive documentation to alleviate the administrative workload for healthcare workers. Over documentation is a waste of valuable resources.

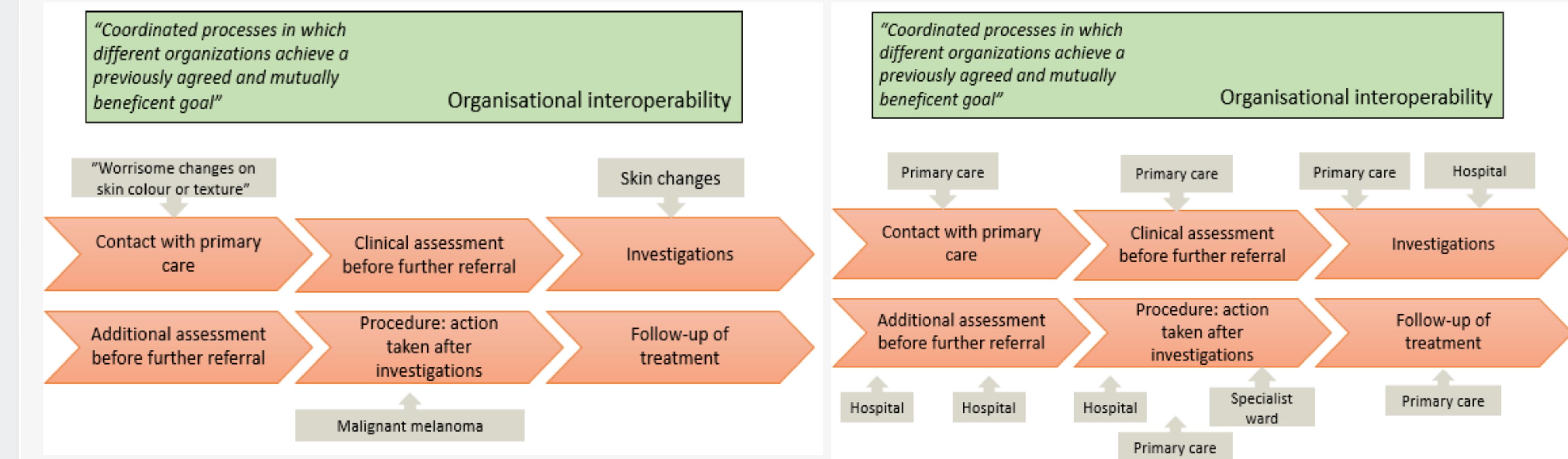
The current healthcare system in Sweden is going through a national paradigm shift caused by a national decision to replace the old healthcare systems with new EHR systems in certain regions along with upgrading current EHR systems in other regions. The central focus in this shift is on how patient data, clinical investigations, diagnoses, treatments and follow-ups should be documented. Our use case is standardising documentation in cancer care (SoS DNR 4.3-31831/2019). Cancer patients require rapid referrals from the time of suspected diagnosis to the start of treatment. National cancer programs for each type of cancer diagnosis have been established as guidelines for the entire cancer care plan. Information captured and documented according to these guidelines should therefore be accurate, consistent and easily accessible.

The use of CIM can assist in standardising documentation through data capture of clinical information by ensuring consistency of data input. Its application can also improve interoperability within a hospital setting and externally with other users of hospital and clinical data. To achieve these goals, the National Board of Health and Welfare, which is the national provider of informatics and SNOMED CT support, is working on the design and development of CIMs for use in the Swedish healthcare system. The focus of this paper is primarily to describe examples of CIM and this work is ongoing.

Background

Sweden is divided into 290 municipalities and 21 regional councils. Swedish healthcare is (largely) government-funded and **decentralized**. Responsibility lies with the regional councils and in some cases, with the local councils or municipal governments. Each region has its own mandate to drive healthcare decisions, while the central government sets the political agenda for healthcare. Due to this the current Swedish national healthcare is highly fragmented.

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The figures above shows an example of coordinated process-models of a person with skin changes and who is seeking medical consultation, and who is later referred to or is receiving care at outpatient clinics and/or hospitals.

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METHODS



Strategy:

A) The identification of common information blocks related to cancer care:

The Swedish national quality registries for cancer is the only source of structured data available today. Each registry contains a summary of data selected and extracted from respective EHR systems. Although the data is structured, data transfer from EHR systems to registries is done manually. To identify which information is important and common, different cancer diagnoses data sets from different national quality registries were aligned and assessed (1). However, it is important to note that registries represent a very selective type of data output, while clinical data collection is not represented in these instances; more work to identify these types of data collection is needed.

B) The design for CIMs is based on the Swedish national information structure and reference models (NI) with terminology binding to Snomed CT concepts (2).

Define the problem:

Even though all hospital systems are digitalised, excessive documentation is a major issue and much of it is done manually, and in a poorly structured or non-standardised format. Over documentation in any healthcare where interoperability is lacking, will affect the administrative workload placed on medical professionals. It will also decrease the overall efficiency in the healthcare and it may even have a negative effect on patient safety.

The Cause:

The major cause of over documentation is the lack of system integration and the lack of a structured and standardised manner to capture and to store information (3). Each hospital has developed their own system to fit their individual needs and uses. At each visit to a healthcare provider, the patient's health profile and results from every investigation is documented separately; hence, generating inconsistent and fragmented data.

The Extent:

A survey showed 15% of nursing documentation content was also documented elsewhere at least one or more times within the EHR. Additionally, 43% of content documented in nursing history was double-documented and 41% of nursing assessment content was documented in another profession's assessment (4). Over documentation is resource consuming, error prone and frequent rechecking is required to ensure that important information is intact.

Potential solution:

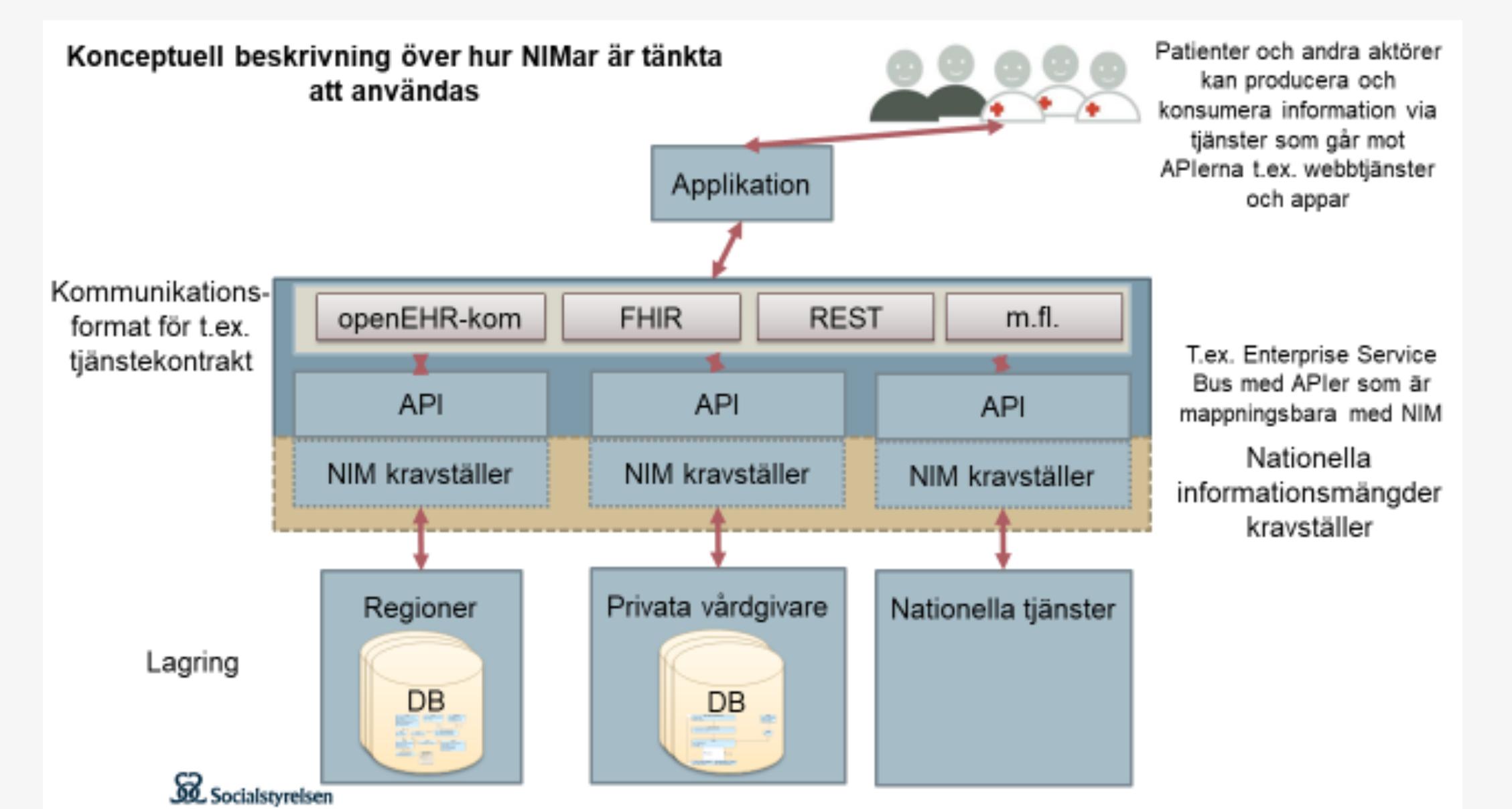
By applying CIMs, system integration will improve, which will enhance the semantic and technical interoperability between different EHR systems. These CIMs developed must therefore be EHR system independent. The benefit of using CIMs, lies in that, the entire CIM is reusable, and that the data captured ensures reproducibility of the clinical information it contains. This is not a unique approach as other countries have also developed similar solutions for their national use (5, 6).

Maintenance:

It is important that the data recorded through a CIM is standardised, regardless of where it is used. This is achieved by agreeing upon the semantic meaning it carries and the information structure within these models. These criteria should be adopted when developing clinical information models for use both in health and welfare. By documenting clinical information in a formalised structured way, the system can ensure information input is accurate, consistent and accessible in a timely manner.

Verification of CIM:

Before any CIM is released for use, it has to be verified. We are in the process of building a platform to verify the usability of the CIMs developed. The Swedish equivalent for CIMs is NIM (nationell informationsmängd).

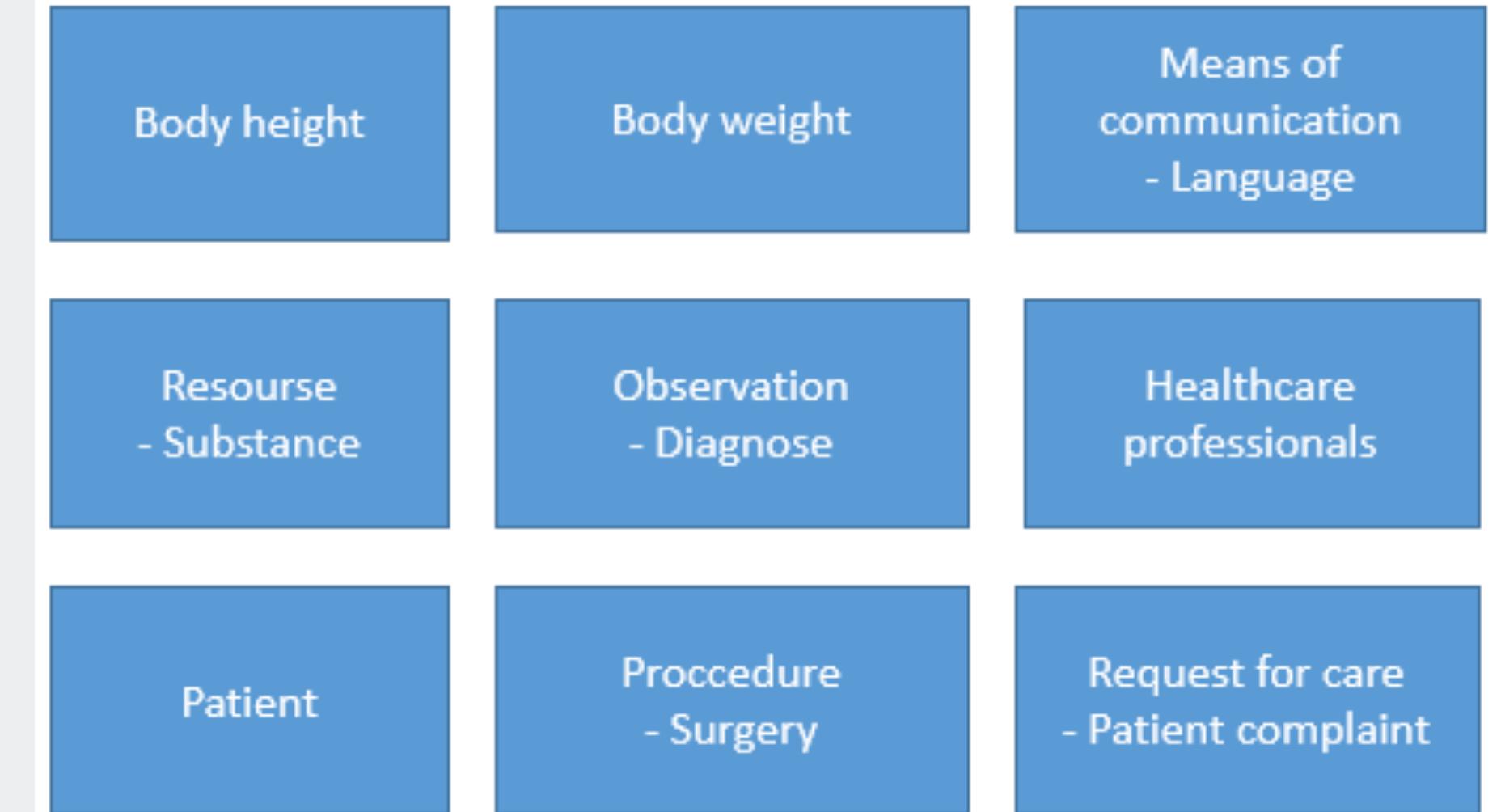


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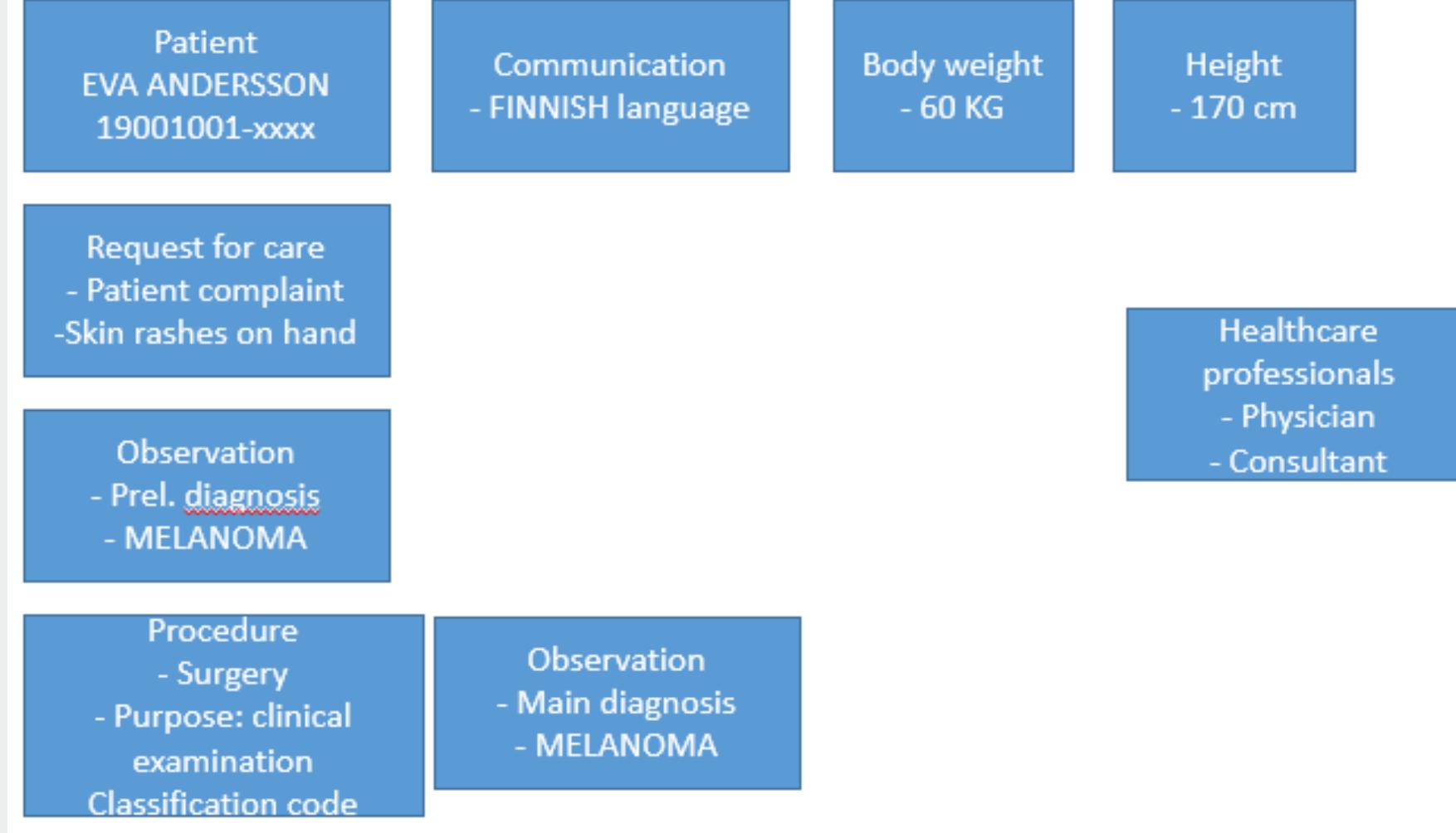
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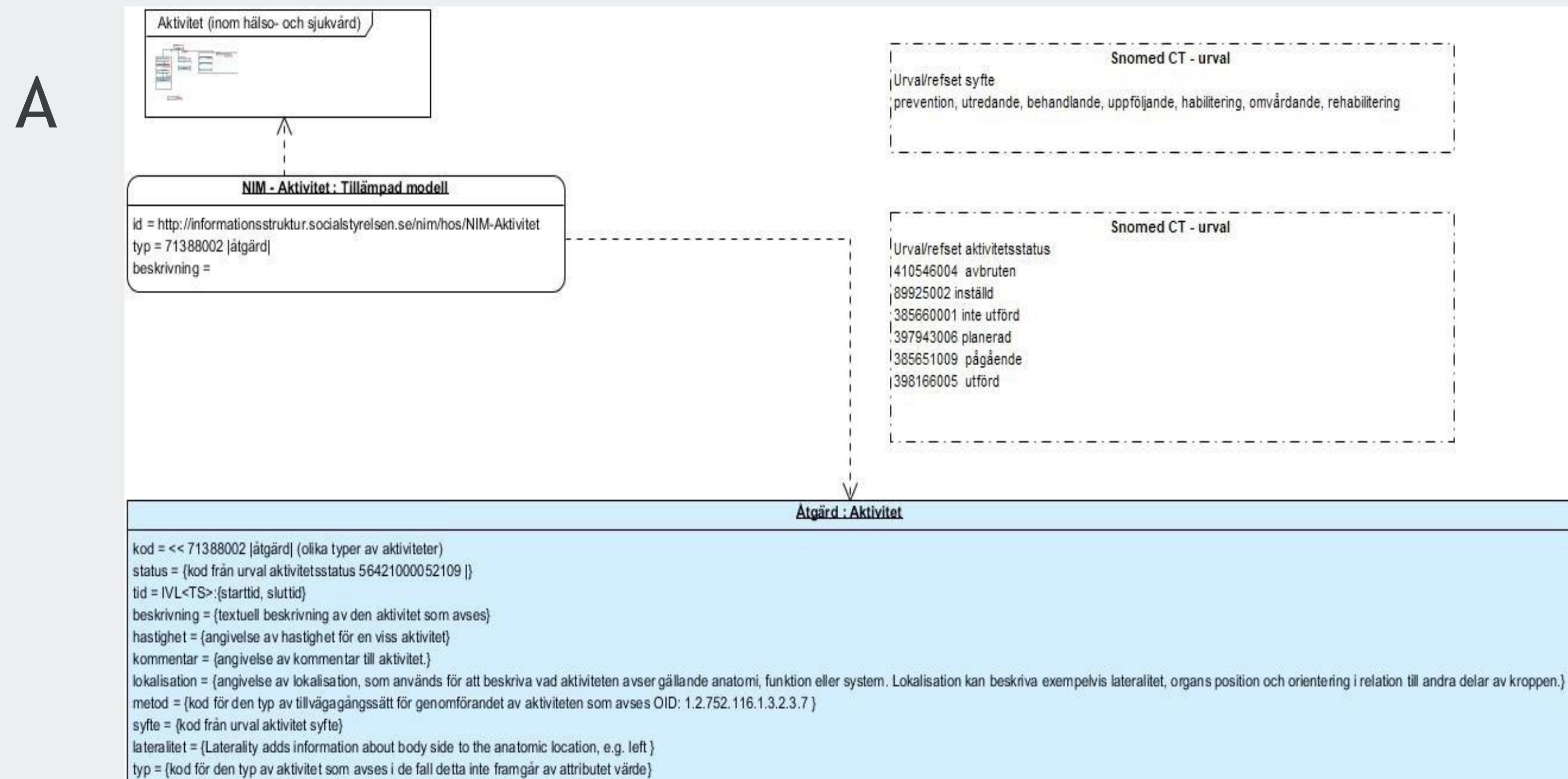
Process-independent CIMs



An example where CIMs can be applied



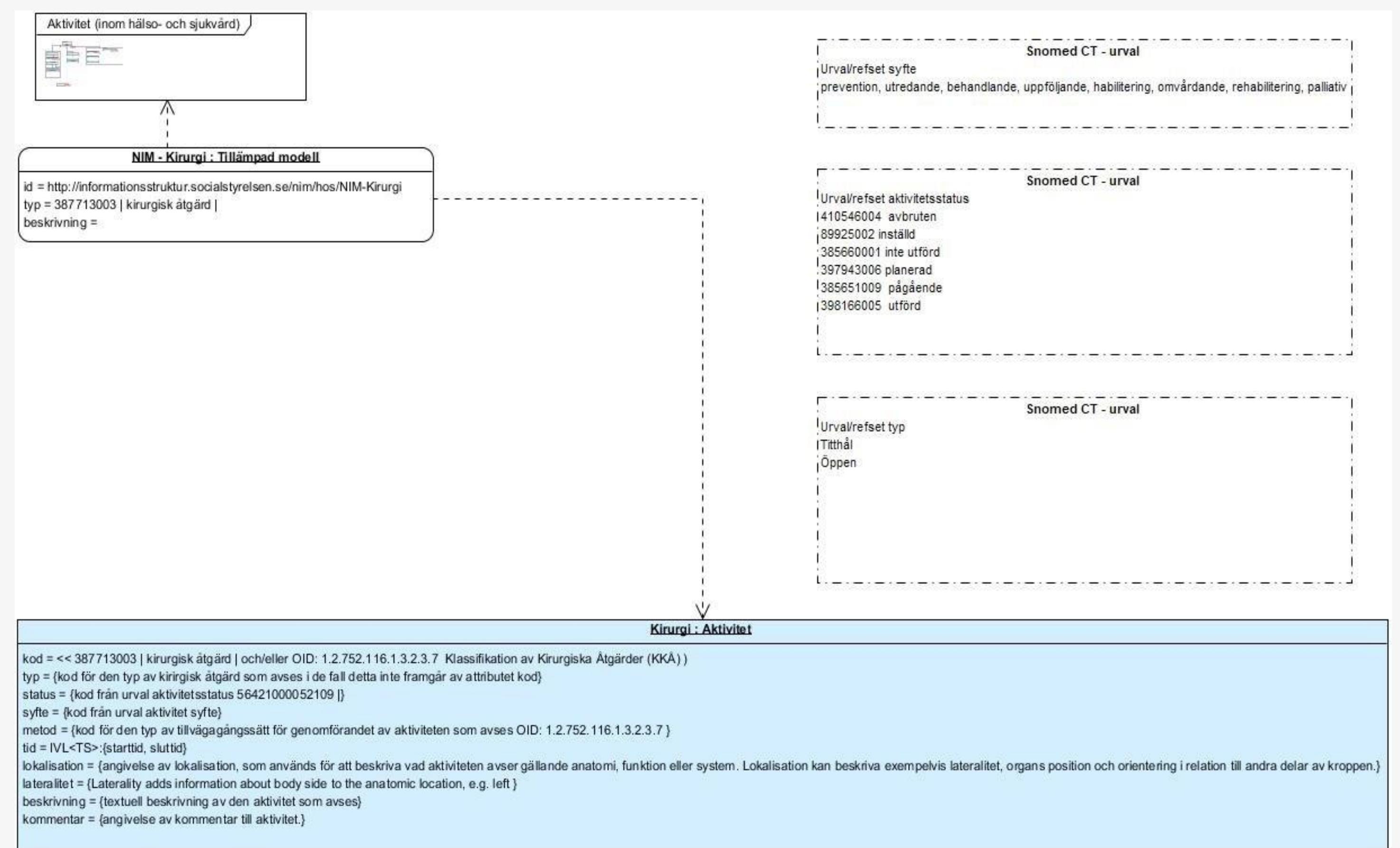
CIMs are based on national information structure and reference models, designed and maintained by the Swedish Board of Health and Welfare. The illustration below shows an example of how a CIM from a generic status i.e. Procedure (åtgärd) (A) is connected to a CIM i.e. Surgery (kirurgi) (B), which is one-step down in the hierarchy. The content in A will contain information on procedures for cancer treatment*.



As an example, *The 7 alternative procedures for treatment of melanoma are:

- Surgery
- Curative chemoradiotherapy
- Cytostatic therapy
- Radiation therapy
- Stereotactic radiation therapy
- Radiotherapy for distant metastases
- Other tumour therapy

The CIM for Procedure and Surgery can be applied to any tumour. However, the CIM for Diagnosis must be included to specify the specific diagnosis the procedure is to be applied to.



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DISCUSSION



Discussions

The CIMs created by the National Board of Health and Welfare are process- and system-independent. Hence implementation and use is not hindered by differences in the various EHR systems. The National Board of Health care Welfare provides fully developed CIM for convenient utilisation for systems developers and other stakeholders in healthcare. However, there are a number of challenges to consider:

- a) There is a need for additional oversight during restructuring of new healthcare systems to ensure they are compatible with recommended products and terminologies.
- b) There remains a cumbersome transition period in relation to continued support of the old systems during information transferring and archiving stages,
- c) There will be a need to establish continual partnerships with various stakeholders regarding set up, planning and managing the long-term maintenance of CIMs.

Conclusions

The CIMs developed by the National Board of Health and Welfare are based on the national information models, which are based on the Swedish legislation that all national registries abide by.

The development and use of CIMs is a smart way to deal with the counter-productive method of documenting clinical information today, especially within our national cancer care program. Unmistakably, it is the solution to ensure correct documentation practices nationally regardless of the different healthcare systems in Sweden. The use of CIMs can most certainly improve the semantic interoperability, efficiency and safety in healthcare.

Future Directions

There are ongoing work to develop CIMs, not only for cancer care but for use in different care areas and other levels of care. The goal is to provide all patients with equal opportunities for good and efficient care.

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