Of course, semantic interoperability must be more than just an agreement on a formal exchange standard; crucial is how the semantics of the content are recognized and exchanged. But how should this be done? Most authors propose a fixed standard in the form of a classification (ICD-10) or a nomenclature (SNOMED CT) [1]. At first sight such a solution looks simple and sound. A closer look, however, reveals serious problems:

- Data entry: If taken seriously, a large workload awaits.
- Definitions of semantics are not trivial. For standards they must be explicit. They must be taught.
- Standards are always subject to change. No standard fits all goals.
- Utilisation is narrowly limited by the focus of the standard and the quality of data entry.

In order to clarify the correlation between standards and semantics, we examined the way in which five different standards describe abdominal hernias. We looked for the semantic types used for the differentiation of the hernias by the different standards. A semantic type (or dimension) is an independent attribute or feature with its own expressions, for example, the type “colour” with its expressions “green”, “red” etc. We found eleven independent semantic types used for the description of hernias, among them location, complication, period, acquisition, etc. The semantic types were arranged in various configurations by the standards. Only the type “location” was used by all standards, all other types were missed by at least one standard. No standard used all types. If a type is not expressed by a standard, it cannot be interoperated. Considering the great heterogeneity, it is obvious that no standard will fit all purposes.

In addition, the analysis exhibits a general characteristic of all standards: the antagonistic goals of overview and precision. Both goals cannot be achieved at the same time. When standards emphasise overview, they miss details. If they emphasise details, they lack overview. This is by no means trivial. The more detailed the standard, the more strongly it becomes affected by combinatorial explosion [2], which makes interpretation and interoperability a very time-consuming, if not impossible manual task. The described effects cannot be prevented by a “better” standard, but are due to the nature of standards as such. In particular, it is not possible to make a “complete” standard which contains all types and their expressions. Even a multidimensional standard, which is more apt to face combinatorial explosion, cannot express in a practicable way all the necessary dimensions (types), because there are too many of them (in our limited example already eleven) [2].

How can we achieve semantic interoperability, considering all these problems? The solution lies in a dynamic approach [3] instead of a static (= standard based) one. The dynamic approach analyses the semantics of the medical languages and standards that we want to interoperate, then builds composite concepts combining these types and uses transformation rules containing the composite concepts. In this way, it is possible to respect all semantic types in use and the meanings are made interoperable, even between heterogeneous sources, codes and medical languages. No demands or restrictions concerning the use of a specific vocabulary are required from clinicians and users.

References


Correspondence: Hans Rudolf Straub, MD
Semfinder AG
Hauptstrasse 53
CH-8280 Kreuzlingen
straub@semfinder.com

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