

# Creating a Vaccine Adverse Event Ontology for Public Health

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## Abstract

Creation of an ontology for Adverse Events Following Immunization (AEFI) can help immunization stakeholders better understand adverse events. Moreover, it enables the sharing and reuse of machine-readable knowledge and enhances surveillance systems. Linkage of this knowledge base to controlled vocabularies establishes the foundation for integration of information from different applications. This work describes the framework for ontology creation, the collaborative work supporting it and the overall mission of informatics to bridge organizations and enable knowledge sharing.

## Introduction

Existing biological knowledge is extended by applying what we already know to unknown situations and events. The ensuing knowledge explosion from these extensions in health care domains, as well as from rapid advances in health care and related technologies, makes automation in health information management an essential activity in the delivery of health care services and in public health surveillance and response. An ontology is a formalized knowledge base that can be represented as machine-readable code using Resource Description Framework (RDF). The Brighton Collaboration is a voluntary international organization that develops case definitions for Adverse Events Following Immunization (AEFI). The case definitions are highly structured and lend themselves to abstraction and model representation. This paper describes the framework to convert these case definitions into an AEFI ontology.

## Methods

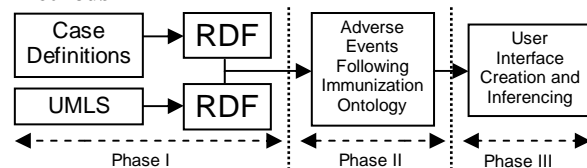


Figure 1. Framework for AEFI Ontology Creation

In the first phase, concept modeling is carried out using Universal Modeling Language (UML).

Subsequently, the concepts, roles, and objects from case definitions and the UMLS concept table were coded using an intermediate serialization language called N3, which was then compiled to RDF. During the second phase, the two RDF files will be merged to create an AEFI ontology. In the final phase, user interfaces will be created to help users to query the ontology. The Office of High Performance Computing and Communications at the National Library of Medicine currently provides UMLS expertise, hosting, and processing power for these activities. The open source approach is adopted to encourage redistribution, customization, modification, and enhancement of source code.

## Results

We have completed conceptualization of AEFI case definitions and programmed case definitions and UMLS concepts into RDF. Using this ontology, the level of diagnostic certainty could be automatically determined given a set of clinical manifestations. We also successfully worked together to contribute informatics, domain and technical expertise and leveraged existing resources of each collaborating partner.

## Discussion

Ontologies in public health can serve as repositories of formalized domain knowledge and enhance public health surveillance systems and registries. If made freely accessible, like the Brighton Collaboration case definitions, the implementation of these standardized knowledge bases will help avoid duplication of effort and make them useful in several vaccine safety applications. Ontologies written with semantic web standards, such as RDF, allow reuse by enabling people to merge them with other domain-specific ontologies. Ontologies promote disambiguation of terms as well as system interoperability and semantically-consistent information exchange. Ontologies in public health are enabling resources and by making them freely accessible to stakeholders this may allow for more specific AEFI reporting.