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D.2.4. CARRE metadata scheme & ontology

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Executive Summary

This deliverable presents the first, complete version of the CARRE ontology. Apart from the ontology itself, this document discusses issues related to the development approach. This approach comprises both of the methodology as well as of the tools developed for crafting the CARRE vocabulary. Hence, the deliverable is divided into three parts:

- The first part presents the ontology and discusses the design decisions made from a conceptual point of view.
- The second part presents the technology developed for acquiring the knowledge described in the ontology
- The third part presents the actual ontology, along with the output of its documentation.

About CARRE

CARRE is an EU FP7-ICT funded project with the goal to provide innovative means for the management of comorbidities (multiple co-occurring medical conditions), especially in the case of chronic cardiac and renal disease patients or persons with increased risk of such conditions.

Sources of medical and other knowledge will be semantically linked with sensor outputs to provide clinical information personalised to the individual patient, so as to be able to track the progression and interactions of comorbid conditions. Visual analytics will be employed so that patients and clinicians will be able to visualise, understand and interact with this linked knowledge and also take advantage of personalised empowerment services supported by a dedicated decision support system.

The ultimate goal is to provide the means for patients with comorbidities to take an active role in care processes, including self-care and shared decision-making, and also to support medical professionals in understanding and treating comorbidities via an integrative approach.

Terms and Definitions

The following are definitions of terms, abbreviations and acronyms used in this document[1].

Term	Definition
BBC	British Broadcasting Corporation, http://www.bbc.com/
BioPortal	An open repository of biomedical ontologies that provides access via Web services and Web browsers to ontologies developed in OWL, RDF, OBO format and Protégé frames
Class (ontology)	A named set of individuals.
CMO	Clinical Measurements Ontology
Data property (ontology)	A relation between instances of classes and RDF literals and XML Schema datatypes.
DoW	Description of Work
DSS	Decision support system
FOAF	Friend of a friend ontology, http://www.foaf-project.org/
ICD	International Statistical Classifications of Diseases
Individual	A concrete object or an abstract individual member of the ontology.
Linked Data	A method of publishing structured data so that it can be interlinked and become more useful.
LOINC	Logical Observation Identifiers Names and Codes ontology
MedLinePlus	An educational resource database provided by the US National Library of Medicine
OAuth	Open standard to authorization
Object property (ontology)	A relation between instances of two classes.
OWL	Web Ontology Language: A language that can be used to describe the classes and relations between them that are inherent in Web documents and applications
Property (ontology)	A general fact about the members of classes and specific facts about individuals.
PUBMED	A service of the US National Library of Medicine that provides free access the NLM database of indexed citations and abstracts to health sciences journals
QUDT	Quantities, Units, Dimensions and Data Types Ontologies
RDF	Resource Description Framework: a standard model for data interchange on the Web.
SNOMED SNOME-CT	Systematically organized computer processable collection of medical terms providing codes, terms, synonyms and definitions used in clinical documentation and reporting
SPARQL	An RDF query language.
Subject, predicate, object	A subject denotes the resource, and the predicate denotes traits or aspects of

[1] Terms and definitions are taken from W3C and Wikipedia.

(triple)	the resource and expresses a relationship between the subject and the object.
SWAT	Semantic Web Authoring Tool, http://swat.open.ac.uk/swat
Triple	A statement in the subject-predicate-object expression.
UMLS	Unified Medical Language System: is a compendium of many controlled vocabularies in the biomedical sciences
UMLS CUI	UMLS Concept Unique Identifier
URI	A string of characters used to identify a name of a resource.
URL	A specific character string that constitutes a reference to a resource.
Vocabulary/ Ontology	The concepts and relationships (also referred to as “terms”) used to describe and represent an area of concern.
W3C	World Wide Web Consortium, http://www.w3.org

1. Introduction

Medicine has a long history of formalising and categorising knowledge. One of the first organised attempts to catalogue diseases goes back to the 19th century, when the first International Classification of Diseases was crafted (ICD)[2]. ICD which is now in its 10th version has become a world standard, adopted by the World Health Organisation[3]. The benefits of formalising medical knowledge have been recognised since the first generation of information systems. However, the first computer systems followed a monolithic architecture, where the knowledge base was embedded deep into the system and could not be shared or reused else[4]. The arrival of the World Wide Web signalled the explosion of information and the corresponding enormous technological capabilities, whereby anyone can create and access a web document instantly. Today, information that does not exist on the Web is hard to access, so much that some may claim that it does not exist.

Despite the capabilities offered by the modern Web, a number of limitations continue to exist. These limitations concern the reduced knowledge that comes with the Web of Data. Capturing this knowledge – commonly described as *Semantics* in computer science – is the vision of the Semantic Web, which enables machines to process this information seamlessly. Semantic Web operates at the finer level of individual statements about data[5]. Typically, these statements are annotated using Web Ontologies[6]. Web ontologies constitute the cornerstone of the Semantic Web. The Semantic Web and ontologies assert the decomposition of monolithic systems into reusable building blocks. Ontologies manage to separate knowledge from the programs operating on top of them. Through the identification of general classes of entity and relations between them, they manage to describe a specific problem domain without loss of generality and reusability.

The standard language for representing ontologies is OWL[7], the Web Ontology Language. OWL is a logical formalism for representing classifications of and relationships between entities. For example, OWL may contain a class (set of entities) labelled “Disease”, whose members are individual diseases. “Disease” may be a subclass of, e.g., “Diagnosis”, which is a more general term; “pregnancy”, for instance, may be a non-Disease Diagnosis. Relationships between entities and classes are expressed via OWL properties: “is a measurement of” could be a property relating the classes “Biomarker Measurement” and “Patient”, for example: “A biomarker measurement is a measurement of exactly one patient”, i.e., it is not possible to have a biomarker measurement which is not in fact a measurement of an individual patient, and no biomarker measurement can be a measurement of more than one patient. These statements may seem obvious, indeed, too obvious to need stating to a human. Of course a single blood pressure measurement can only relate to a single patient. However, for machine processing and inference, such “obvious” statements are anything but. An ontology will spell out the basic semantics of its terms at the level of detail necessary for machine processing.

This document presents the first full version of the CARRE ontology. CARRE aims at providing a general scheme for the description of all concepts identified in Task 2.2 (patient, disease, symptom, risk, treatment, lifestyle, sensor input, alarm, medical evidence, educational material, etc.) and their relationships as specified for the case of cardiorenal disease and comorbidities[8]. For the development of this ontology the following decisions were made:

- Since the beginning of the project (as in DoW), the consortium agreed that the development of our own, in-house ontology was most suitable. This decision was made on the basis that no vocabulary constitutes a perfect fit for CARRE[9]. Building an ontology which is completely dependent on external

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2 http://www.who.int/classifications/icd

3 http://www.who.int/

4 T. R. Gruber. The role of common ontology in achieving sharable, reusable knowledge bases. KR, 91:601–602, 1991.

5 D. Allemang and J. Hendler. Semantic web for the working ontologist: effective modeling in RDFS and OWL. Elsevier, 2011.

6 For the remaining of this document, the terms “web ontology” and “ontology” will be used interchangeably.

7 http://www.w3.org/standards/techs/owl

8 CARRE Description of Work.

9 BioPortal lists 383 distinct ontologies http://www.bioontology.org/BioPortal.

vocabularies could have two implications. On the one hand, we would have chosen a limited number vocabularies with the risk of leaving important CARRE concepts out. On the other hand, we would have chosen a large number of ontologies that would have increased the resulting ontology's complexity dramatically and would have decreased its usability.

- While we chose to build our own ontology, every consideration was made to link this ontology to external vocabularies. Linking an ontology to external vocabularies offers a number of advantages[10], such as:
  - CARRE ontology is an active member of Linked Open Vocabularies. Anyone interested in adopting our vocabulary can freely do so.
  - CARRE ontology benefits by not having to "re-invent the wheel" for every concept or terminology. In our approach, we manage to successfully link align CARRE terms with common standards, such as ICD10, PUBMED and ICD10PCS.
- While it is always tempting to "model the world", this deliverable restrains itself in describing and addressing the concepts as identified in CARRE up until now. In doing so, we believe we offer a meaningful, highly usable ontology that may be easily extended.

The remaining of this document is structured as follows:

Section 2 presents the CARRE information model & ontology from a conceptual point of view. It discusses the development approach adopted for crafting the Risk factor and the Readings and Measurements ontologies. It also discusses the external classes and properties used to link the CARRE vocabularies with external ontologies. Section 3 presents the knowledge acquisition technologies used for populating the expected data. Finally, the Appendices present the generated ontologies.

[10] For a more detailed discussion, see the Linked Open Vocabularies (LOV) project: http://lov.okfn.org/dataset/lov/about/

2. CARRE information model & ontology

The CARRE ontology is comprised of two parts. The first part captures the medical knowledge with regards to risk factors associated to cardiorenal comorbidities. The second part describes the data captured in medical readings that are relevant to the risk factors described in the first part. In the following subsections we present these parts separately for ease of reading. However, the overall approach brings these two vocabularies together and establishes an integrated environment for describing the CARRE ontology.

Before we proceed with the presentation of the ontology, we would like to discuss a few issues that were taken into account when designing the ontology. First of all, the ontology presented here is not intended to be final or complete. Until the ontology is used for real in future stages of the project, we cannot completely identify exactly where possible improvements are. The approach in the project is to describe the core, basic concepts that have been identified for CARRE. Hence, the aim here is to derive a model that can capture the medical knowledge produced in the CARRE project and at the same time develop it in a way that allows extending it even further. This extension may take place within the CARRE consortium itself as the project progresses, or from any stakeholder who wishes to reuse the ontology. For this reason, we are publishing this ontology to the BioPortal public directory:

http://bioportal.bioontology.org/ontologies/CARRE

Since we plan to continue working on the ontology in the following months, changes are expected to be necessary. To support the expected changes, we will keep versioning on the ontology published and keep all previous versions.

One of the primary aims of the CARRE ontology is to become an active member of the Linked Open Data ecosystem. As such, we aim, wherever possible, to make use of external standard vocabularies to denote common concepts, in order that any public data generated by the project can be used easily, and conversely, in order to allow the project to use external public data easily, where relevant. A key contribution of this deliverable is the set of mappings between CARRE terms and external terms.

Technically speaking, this means that the CARRE semantic model should be encoded in a standard ontology language such as OWL, and that the terms, where possible, be drawn from appropriate public external vocabularies.

The “core” of the CARRE ontology is the semantic representation of the D.2.2 data model for risk, intended to represent current medical knowledge regarding cardiorenal risk factors. This core relates to *public* data; that is to say, data from the medical literature regarding conditions, genetics, demographics and the environment, how these factors interact and the studies and evidence quality relating to their interactions. The conceptual model of this public part of CARRE data has been presented in CARRE Deliverable D.2.2.

A separate module of the CARRE ontology relates to *private* data; that is, data relating to particular individual patients. This private data set derives from personalised sensors and other personal data sources, as described in CARRE Deliverable D.2.3. In the context of CARRE, of which personalised sensors are at the heart, this data primarily consists of sensor readings, and so the ontology is largely concerned with representing the semantics of readings and measurements.

Several of the use cases for the CARRE ontology require the representation of information which at first glance does not seem to be modelled here. In particular, in order to provide a Decision Support System (DSS), the CARRE environment needs not only to have some idea of *risk*, but also one of *action*: if a patient is at risk of a particular outcome, what actions can be recommended in order to mitigate that risk? In fact, due to the design of the model, it would be overcomplicated and unnecessary to have an Action class. We can already represent clinical (or extra-clinical) *interventions* within the model, as risk elements (see D.2.2. for a detailed treatment of these concepts). The initial motivation for this was to handle the fact that interventions may well be associated with possible negative consequences, which must be represented. However, there is nothing inherent in the model demanding that risk factor targets must be in any way negative for the patient. Positive interventions may therefore be easily represented using our risk factor model: an intervention such as the prescription of anti-hypertensive medication may be associated with a target condition of “decreased blood pressure”, with a particular probability drawn from clinical evidence. The CARRE DSS may therefore recommend interventions (broadly construed) when the model suggests they could lead to improvements in the patient’s status. Lifestyle modifications may be represented in a similar way, as behavioural risk elements associated with positive outcomes.

Another key use case for CARRE relates to patient education. An empowered patient is one with easy access to accurate and digestible information about her conditions or comorbidities. Possible sources for educational material include MedlinePlus[11], which provides a wealth of patient-focused information on many medical situations. Should the CARRE ontology contain explicit representation of educational material and its content? Thanks to the use of standard Semantic Web technologies and annotations, there is no need. The annotation of CARRE terms with external vocabularies such as ICD10 and UMLS enables such resources to be drawn in automatically – for example, UMLS provides mappings between ICD10 codes and MedlinePlus ontology[12] terms. This means that external sources such as this can be linked directly to CARRE data without any extra commitment or maintenance, and that metadata about such sources (e.g., target audience, reading level, and so on) remains where it belongs, at the data source.

2.1. Development

Semantically, the CARRE data model and the readings and measurements model can be represented using comparatively simple logical constructions. Practically, it is important that the ontology be accessible to the clinical partners of the CARRE project, for validation and use. We decided, therefore, to develop the ontology using natural language tools for knowledge representation. In particular, we chose to use the OWL Simplified English[13] ontology editor[14] (see Figure 1) developed during the SWAT project[15], and to present an automatically generated textual glossary version of the ontology from the SWAT Tools verbaliser[16].

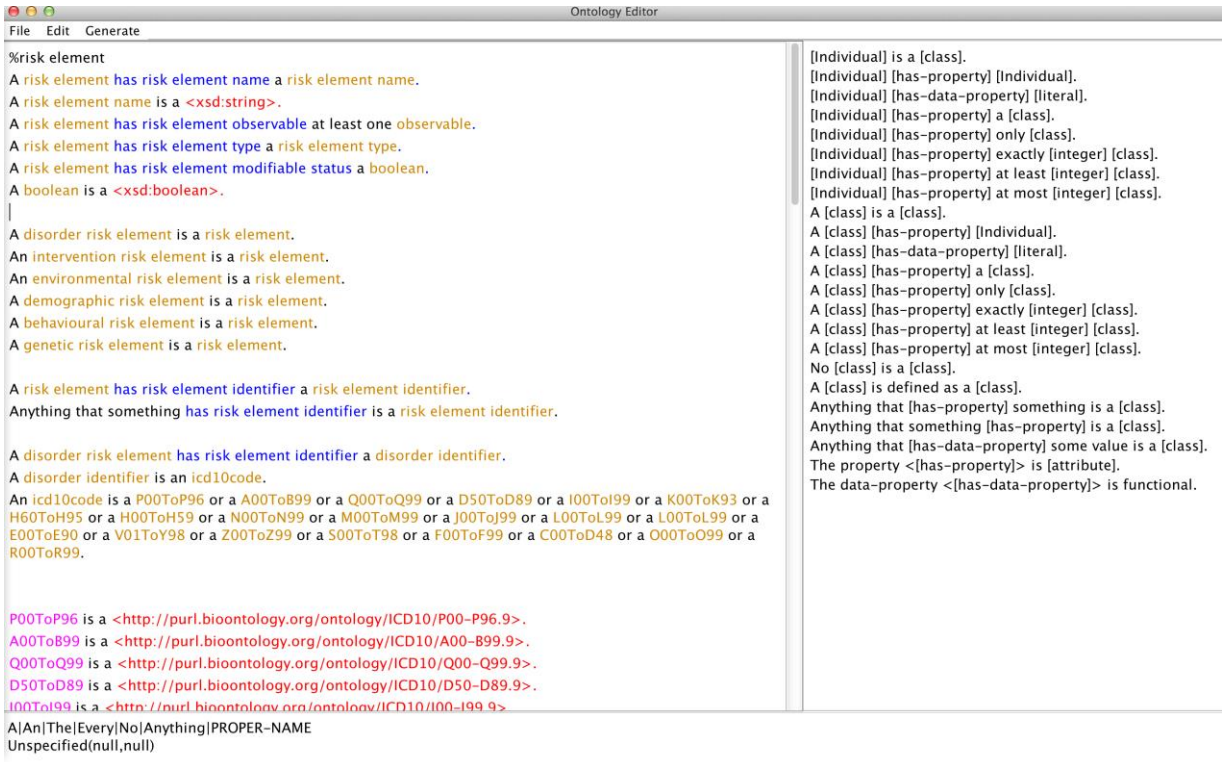

Figure 1. A screenshot of the SWAT ontology editor.

[11] http://www.nlm.nih.gov/medlineplus/

[12] http://bioportal.bioontology.org/ontologies/MEDLINEPLUS

[13] Power, Richard (2012). OWL Simplified English: a finite-state language for ontology editing. In: Third International Workshop on Controlled Natural Language (CNL 2012), 29-31 August 2012, Zurich, Switzerland.

[14] Williams, Sandra; Power, Richard and Third, Allan (2014). How easy is it to learn a controlled natural language for building a knowledge base? In: Fourth Workshop on Controlled Natural Language, 20–22 August 2014, Galway, Ireland, Springer International Publishing AG.

[15] EPSRC EP/G033579/1 “Semantic Web Authoring Tools”

[16] http://swat.open.ac.uk/swat

The advantages of the SWAT editor are that it enables very rapid prototyping of ontologies in a readable form, and that certain very common but tedious semantic constructions can be generated automatically by the editor and manually verified or edited afterwards. This latter process is considerably faster and less error-prone than manual input directly into an OWL formalism.

The approach is to develop the ontology within the SWAT editor solely in OWL Simplified English, and to export to OWL/XML as a final stage – keeping the OSE text as the "source" code for the ontology. External vocabularies are not directly referenced within the ontology; rather, the appropriate mappings between CARRE terms and external terms are represented in an external file in the Turtle format[17]. This approach (taken also by, e.g., the BBC Linked Open Data group[18]) allows flexibility and maintainability without sacrificing interoperability or expressiveness. Changes to external vocabularies or ontologies can be accommodated with minimal disruption, and data expressed using the CARRE terminology can be easily (and automatically) queried using the appropriate external terminology.

2.2. Risk factor ontology

2.2.1. Risk factor, source(s) and target risk elements

Figure 2 illustrates the ontology for the CARRE risk factors. As already indicated by its title, the basic building block of the ontology is the *risk factor*. Risk factor is a complex class, which aims to describe the causal relationship between one or more risk elements, appearing as *source*(s) and another risk element, named as *target*. The *risk element* class represents everything which can be the source or target of a represented risk factor. That is to say, if a patient X is subject to a particular risk element (or set of risk elements) – the *source(s)* - then X has an increased or reduced risk of another risk element – the *target*. For example, "diabetes", "smoking" and "cardiovascular disease" are risk elements. A patient with diabetes who smokes has an increased risk of cardiovascular disease. In this situation, diabetes and smoking are source risk elements, where cardiovascular disease is a target. The usual clinical phrasing would be to say that diabetes and smoking together are a risk factor for cardiovascular disease. The introduction of terms such as "risk element" reflects the increased level of formal detail required to model these semantics for machine processing.

2.2.2. Risk element

Certain classes of risk element are well-delineated and well known. For example, anything of the type "clinical diagnosis" is a candidate to be a risk element. As there are already established vocabularies for clinical diagnoses (SNOMED-CT, ICD9/10), it is straightforward to link risk elements of this type to one of these vocabularies.

Other classes of risk element are more open-ended, and less likely to be covered by one or a small number of vocabularies. For example, *behavioural* risk elements may include "obvious" instances such as smoking, but could potentially include instances from patient occupation (e.g., "works in a chemical factory") to personal habits (e.g., "practices unsafe sex") *Environmental* factors may be as simple as "pollen count" and as complex as "living in a low-income area", and so on.

Many of the behavioural and environmental elements which we wish to model (e.g., smoking) are present in clinical vocabularies, including all of the risk elements currently specified in D.2.2, and so we make use of these vocabularies (and "meta-vocabularies" such as UMLS[19]) in order to represent them. However, this risk model is intended to be generic, and it would be unrealistic to expect that a single existing vocabulary or "meta-vocabulary" already expresses all possible behavioural risk elements, for example. We thus also allow the entry of free text for these fields, allowing a "data-driven" approach for these broad categories.

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17 http://www.w3.org/TR/turtle/

18 http://www.bbc.co.uk/ontologies/assets/data/mappings.ttl

19 https://uts.nlm.nih.gov/home.html

The above discussion and “loose classification” is depicted in the ontology, as it currently shows that some risk elements may be described formally (indeed, a disease or an intervention can be linked directly to an external, well-established vocabulary) while others are more open-ended.

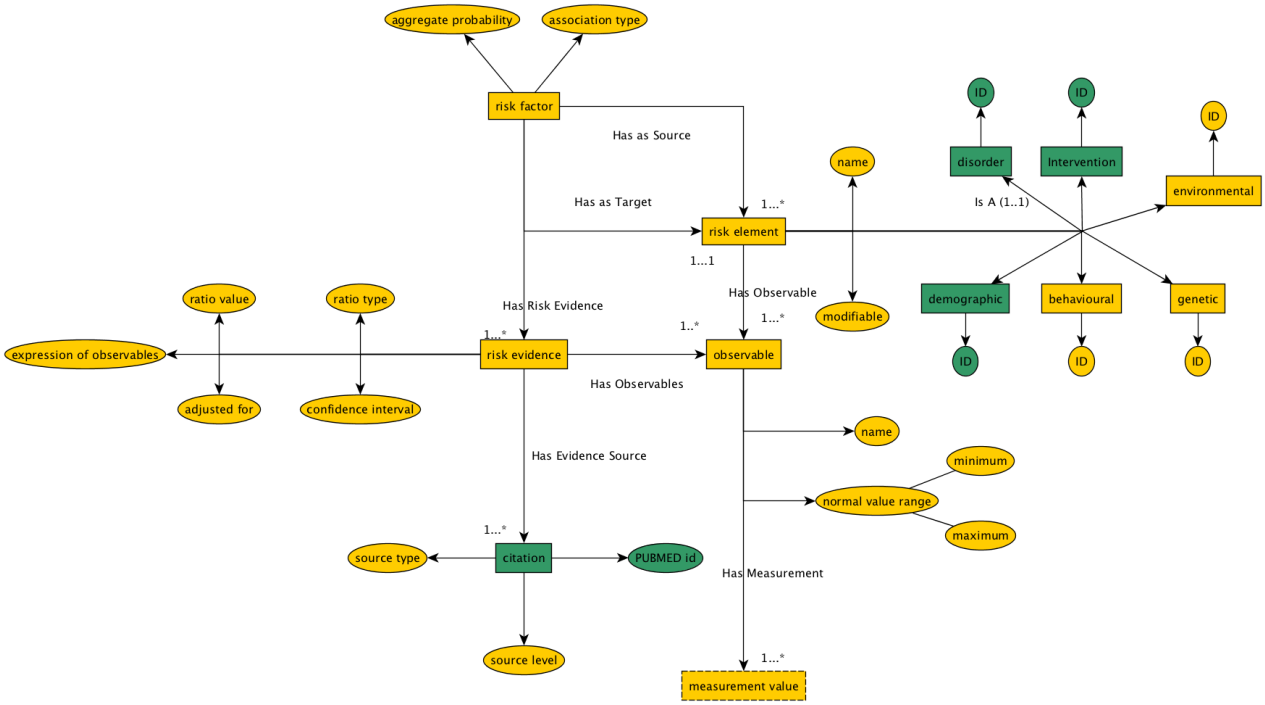

Figure 2: Diagram of the CARRE risk factor ontology. Classes and properties with green background colour denote that these entities are linked to external vocabularies.

2.2.3. Supplementary classes

The remaining of the classes are supporting the information that assert what a risk factor is and its grounds. The class *risk evidence* aims to present and document all information that relates to the risk factor. More specifically, “ratio value”, “ratio type”, “confidence interval” and “adjusted for” quantify the degree of confidence behind an individual risk factor. Of particular interest is the class “observable”. This aims to provide further details behind clinical (or non-clinical) data that can be observed. For example, an observable may be “Pulse”. At the same time, specific “individual readings” can provide values for an observable. The class individual readings is described in detail in the following section. A risk evidence entity may contain an “observable expression”, which is a constraint on the value of a reading of an observable: a piece of evidence may only apply to patients whose pulse is greater than a particular value, for example. Finally, the class *citation* provides reference to risk evidence. Citation constitutes an individual that inherits all properties of a PUBMED record in addition to the properties “source type” and “source level”. These attributes are responsible for describing the extent, credibility and validity of the study found in PUBMED.

The full details of the risk factor classes and properties are presented in Appendix A.

2.3. CARRE Readings and Measurements ontology

The aim of the readings and measurements ontology is to represent the concepts involved in the private data gathering component of CARRE. In particular, it seeks to represent what is involved in the gathering of data from personalised sensors. The development of this ontology has been informed by the software development for the WP4 semantic repository, which at the time of writing is able to collect data from

devices produced by three commercial manufacturers: Fitbit[20], iHealth[21] and Withings[22], although it is designed to be extensible to enable data to be imported from any source. The specific measurable quantities presented in the model correspond to data which is available from these three manufacturers; however, the generic model of measurement is generic, and is expected to grow in coverage as the project progresses. Figure 3 illustrates the ontology for the CARRE risk factors

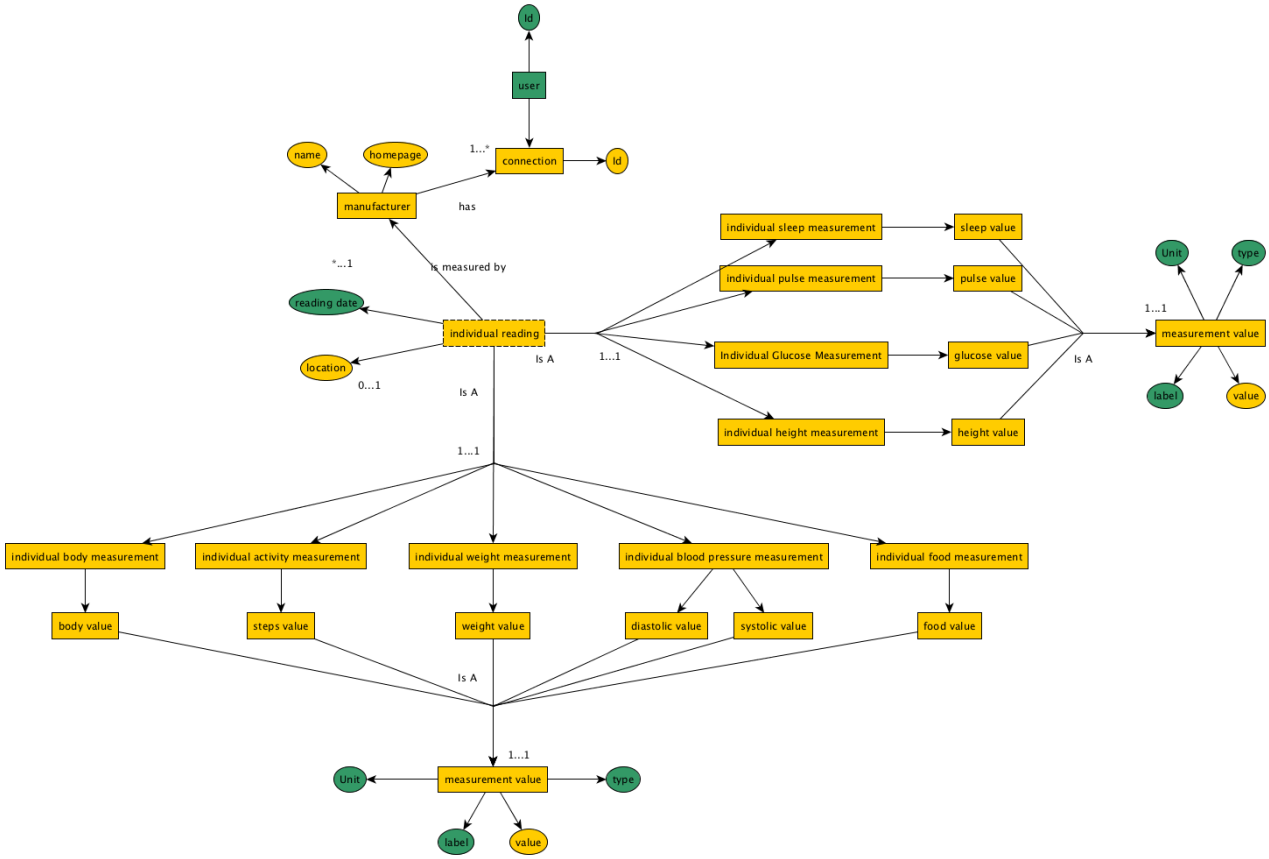

Figure 3: A diagram of the CARRE readings and measurements ontology. “Measurement value” Class is repeated twice for visualisation purposes. Classes and properties with green background colour denote that these entities are linked to external vocabularies.

A *user* (representing an individual person whose data is being represented using the terms of this ontology) has an *identifier* and *connections*. An identifier simply uniquely identifies a user within CARRE, and a connection represents that user’s login details to the cloud service provided by a *manufacturer*. A connection is therefore associated with a set of authentication details, which for security is currently restricted to manufacturer services which use the OAuth authentication model[23]. The OAuth model requires *access*, *request* and *refresh tokens*, each of which may be associated with a corresponding *secret* and which may have an *expiry* time. A manufacturer has a *name* and a *website*.

Procedurally, data for an individual user is gathered from a manufacturer by means of the connection. Data is in the form of one or more *device readings*. For implementation reasons, a device reading is associated with a manufacturer rather than a connection, although it is always possible (since a user may only have one connection with a particular manufacturer) to compute the connection from which a device reading came by inference.

Every device reading must of course have a *date* at which the reading was taken. Some manufacturers also provide location information in the form of latitude and longitude. A device reading may represent a set of

[20] http://www.fitbit.com
[21] http://www.ihealthlabs.com
[22] http://www.withings.com
[23] http://oauth.net

measurements, all of which are semantically related - for example, a device reading may originate with the user stepping onto a set of body analysis scales, which can provide measurements of weight, body fat percentage, muscle mass, and so on. A reading may also have a *provenance*, which at the time of writing is simply whether the measurement came from a device automatically, or was manually entered into a web form by the user, and an *actuality*: manufacturers may provide actual measurements from devices or users, or goal measurements (e.g., a target weight). Finally, a device reading may be associated with a textual note added by the user.

The device reading class has several subclasses, for measurements of *activity, weight, blood pressure, food, pulse, glucose, sleep* and *body* measurements. Each of these has properties relating to the type of *measurement value* represented: for example, an *individual blood pressure measurement* has the *has blood pressure systolic* and *has blood pressure diastolic* properties, which relate it to a *blood pressure systolic value* and a *blood pressure diastolic value*, respectively.

Every measurement value has a common structure. A measurement value has a *measurement type*, which is its type expressed in an external vocabulary, a *value* which can be an integer, string, floating point value, and so on, and a *label*, which is a human-readable string.

The full details of the currently available measurement types are presented in Appendix B.

2.4. External Classes and properties

2.4.1. Risk Factor Ontology

Diseases and diagnoses are described using the ICD9[24], ICD10 or SNOMED CT[25] schemes whereby a disease is identified by a specific code. For instance, let's consider ICD10 which is accessible on the BioPortal website[26]. We used an RDF Version of the UMLS ontology ICD10 which was developed by the National Center for Biomedical Ontology (NCBO) project. According to this ontology, all diseases are subclasses of a collection of top-level code-ranges. These codes are grouped as shown in Table 1.

For **interventions**, we used the ICD-10 Procedure Coding System (ICD10PCS). ICD10PCS describes medical and surgical procedures. The list below summarises the different types of procedures identified in the ontology[27]:

- Administration (Procedure);
- Chiropractic (Procedure);
- Extracorporeal Assistance and Performance (Procedure);
- Extracorporeal Therapies (Procedure);
- Imaging (Procedure);
- Measurement and Monitoring (Procedure);
- Medical and Surgical (Procedure);
- Mental Health (Procedure);
- Nuclear Medicine (Procedure);
- Obstetrics (Procedure);
- Osteopathic (Procedure);
- Other Procedures (Procedure);
- Physical Rehabilitation and Diagnostic Audiology (Procedure);
- Placement (Procedure);
- Radiation Therapy (Procedure); and
- Substance Abuse Treatment (Therapy).

[24] http://bioportal.bioontology.org/ontologies/ICD9CM

[25] http://bioportal.bioontology.org/ontologies/SNOMEDCT

[26] http://bioportal.bioontology.org/ontologies/ICD10

[27] http://bioportal.bioontology.org/ontologies/ICD10PCS

Code/URL	Description
http://purl.bioontology.org/ontology/ICD10/P00-P96.9	Certain conditions originating in the perinatal period
http://purl.bioontology.org/ontology/ICD10/A00-B99.9	Certain infectious and parasitic diseases
http://purl.bioontology.org/ontology/ICD10/Q00-Q99.9	Congenital malformations, deformations and chromosomal abnormalities
http://purl.bioontology.org/ontology/ICD10/D50-D89.9	Diseases of blood and blood-forming organs and certain disorders involving the immune mechanisms
http://purl.bioontology.org/ontology/ICD10/I00-I99.9	Diseases of the circulatory system
http://purl.bioontology.org/ontology/ICD10/K00-K93.9	Diseases of the digestive system
http://purl.bioontology.org/ontology/ICD10/H60-H95.9	Diseases of the ear and mastoid process
http://purl.bioontology.org/ontology/ICD10/H00-H59.9	Diseases of the eye and adnexa
http://purl.bioontology.org/ontology/ICD10/N00-N99.9	Diseases of the genitourinary system
http://purl.bioontology.org/ontology/ICD10/M00-M99.9	Diseases of the musculoskeletal system and connective tissue
http://purl.bioontology.org/ontology/ICD10/G00-G99.9	Diseases of the nervous system
http://purl.bioontology.org/ontology/ICD10/J00-J99.9	Diseases of the respiratory system
http://purl.bioontology.org/ontology/ICD10/L00-L99.9	Diseases of the skin and subcutaneous tissue
http://purl.bioontology.org/ontology/ICD10/E00-E90.9	Endocrine, nutritional and metabolic diseases
http://purl.bioontology.org/ontology/ICD10/V01-Y98.9	External causes of morbidity and mortality
http://purl.bioontology.org/ontology/ICD10/Z00-Z99.9	Factors influencing health status and contact with health services
http://purl.bioontology.org/ontology/ICD10/S00-T98.9	Injury, poisoning and certain other consequences of external causes
http://purl.bioontology.org/ontology/ICD10/F00-F99.9	Mental, behavioural disorders
http://purl.bioontology.org/ontology/ICD10/C00-D48.9	Neoplasms
http://purl.bioontology.org/ontology/ICD10/O00-O99.9	Pregnancy, childbirth and the puerperium
http://purl.bioontology.org/ontology/ICD10/R00-R99.9	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified

Table 1: Overview of the top level codes used in ICD10

Note that for both of these categories, the canonical external link will be provided from ICD10. However, there are instances where the ICD10 categorisations are missing, or are too specific to represent the concepts available in the published clinical evidence. In these cases, we have chosen to allow the use of terms from the broader Unified Medical Language System (UMLS), which includes ICD10 among other

clinical vocabularies, including SNOMED-CT and MeSH. Thus for all risk elements in these categories, we also accept a UMLS Concept Unique Identifier (CUI).

For **demographic** risk elements, we adopt the vocabulary used in HL7 for the case of *race*, which constitutes an "refers to a set of international standards for transfer of clinical and administrative data between Hospital information systems"[28]. For example, a demographic risk element which is used is related to race. HL7 describes several types of races; the following are the top-level races:

- African American;
- American Indian or Alaska Native;
- Asian;
- Native Hawaiian or Other Pacific Islander;
- Other Race; and
- White.

We have also taken into account other cases of demographic information. More specifically, these cases refer to gender and age. The popular FOAF ontology was used for describing this information[29].

Genetic, environmental and behavioural risk elements are annotated using terms from UMLS wherever possible, and by free text entry when not possible, as discussed earlier.

Finally, it is worth noting that while we have linked our ontology to a selection of vocabularies, the mapping we offer constitutes merely the first step towards navigating the network of Linked Vocabularies. For instance, ICD10 which was picked for describing a disease risk element, is already linked – either fully or partially – with at least 22 more vocabularies, as seen on the bioportal website[30].

2.4.2. Readings and Measurements Ontology

The readings and measurements ontology contains concepts which relate to people (users), time (duration and calendar time), location (latitude and longitude), activity, food, and various biomarkers such as blood pressure, blood glucose, and so on.

For most of these cases the choice of external vocabulary is quite straightforward. The FOAF ontology[31] is extremely widely used and well-known, and allows easy representation of data relating to people. By declaring a CARRE user to be a FOAF Person, we can take advantage of the FOAF ontology in the software implementation to record such data in relation to CARRE users and to link to external sources using the same vocabulary.

There are standard W3C[32] ontologies for time[33], time zone[34] and geography[35], which have been used to annotate all measurement types relating to those topics.

The bulk of the readings and measurements ontology concerns measurements relating to activity, food and biomarkers. There are two candidates for vocabularies to use here: the Logical Observation Identifier Names and Codes ontology[36] (LOINC) and the Clinical Measurements Ontology[37] (CMO), both of which are intended to cover the topic of measurements, particularly with regard to human or animal measurements.

It would of course have been possible to use both, and to annotate CARRE terms with more than one external term. However, while this is a convenient approach in the short term, it is against the open principles of the Semantic Web. By annotating CARRE terms with terms from both LOINC and CMO, we tacitly assert a relationship between LOINC and CMO terms, in a way which is not easily, or at all, accessible to machine

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28 http://en.wikipedia.org/wiki/Health_Level_7

29 http://xmlns.com/foaf/0.1/gender and http://xmlns.com/foaf/0.1/age

30 https://bioportal.bioontology.org/ontologies/ICD10?p=mappings

31 http://xmlns.com/foaf/spec/

32 http://www.w3.org

33 http://www.w3.org/2006/time

34 http://www.w3.org/2006/timezone

35 http://www.w3.org/2003/01/geo/wgs84_pos

36 http://bioportal.bioontology.org/ontologies/LOINC

37 http://bioportal.bioontology.org/ontologies/CMO

inference. The better approach would be to map CARRE terms into *one* of those vocabularies, and then to provide an explicit external mapping between corresponding terms in LOINC and terms in CMO.

Some initial effort was made to take this approach, but it quickly became clear that the LOINC vocabulary, despite its prominence, suffered from some significant problems, in particular with regard to its structure. For example, terms relating to blood pressure measurements seem to occur scattered through the structure of the ontology, with no real regard for semantic similarity or difference or for granularity - there is a term for a "blood pressure systolic & diastolic post-phlebotomy", and a term for a "blood pressure home reading", but they are not logically related to one another, and there are no terms for blood pressure readings before or after any other forms of procedure or in other locations. In short, it seems as if it would be quite difficult to use LOINC for any meaningful logical interpretation. As a result, we abandoned attempts to use it, and settled on the (very clearly structured) CMO alone. With one exception: while CMO contains terms relating to calories *consumed*, it contains no mention of calories *metabolised*, and no obvious place in its class structure for such a term to belong. In this case, the LOINC term was used. However, the addition of calories metabolised is among the set of additions we intend to submit to the maintainers of the CMO.

Other proposed additions to CMO include classes relating to activity. CMO has a class "voluntary locomotion measurement", with subclasses for, e.g. "distance travelled on a treadmill", but not for forms of activity measurement from outside the lab. We can presume that these omissions arise from the comparatively recent availability of cheap means of measuring personal activity accurately in a digitally-accessible manner. For measurements from fitness trackers for, e.g., daily step count and floors climbed, we have annotated them simply as CMO's "voluntary locomotion measurement" until such time as the more specific terms can be added to CMO. Other CMO "gaps" related to various body measurements. There is a class for "lean tissue volume", but not for "lean tissue mass"; "whole body water measurement" but nothing more specific (mass/volume); many classes for physical measurements such as waist circumference, forearm circumference, and so on, but not "neck circumference". We have collated these and are preparing a submission to the CMO maintainers with proposed changes and additions.

As well as *types* of measurement, of course, we must consider *units*. There are two main widely used ontologies of units: QUDT[38] and the Unit Ontology[39]. Both are very clear and well-structured; however, the Unit Ontology has better coverage for the units required, and thus we have primarily used terms from there. As with CMO, there are some "gaps" in coverage: in particular, the "mmol/l" and "mmol/mol" units used for blood glucose and HbA1c measurements are missing. These are to be submitted to the UO maintainers.

Surprisingly, the only area for which we were unable to identify an external ontology which was appropriate for the task is that of nutrition. There are ontologies relating to recipes[40] and to dietary planning[41] but we were unable to find an ontology which related to the nutritional content of food. Such an ontology would be extremely useful not just for CARRE but in many other applications. We have created terms to represent those nutritional quantities available in our current data sources, and will, as future work, consider developing a full ontology of nutrition.

[38] http://qudt.org

[39] https://code.google.com/p/unit-ontology/

[40] http://www.bbc.co.uk/ontologies/fo

[41] http://www.researchgate.net/publication/224331263_FOODS_A_Food-Oriented_Ontology-Driven_System

3. Knowledge acquisition

3.1. Collecting Public Data

We have developed a web-based system for clinicians to use to enter this data. This semantic data entry system is described in detail in CARRE Deliverable D.2.2, Annex 1. In short, the Drupal content management system[42] has been customised to reflect the structure of the model presented here, so that observables, evidence sources, risk elements and associations can be entered via web forms, and automatically translated to RDF. The system maintains referential integrity, so that if "diabetes" is entered as a risk element entity, then a risk association representing an observed link between diabetes and hypertension will refer to the existing diabetes risk element entity. Users are supported in the reuse of data already entered into the system by the user interface, which allows existing relevant entities to be selected via drop-down lists wherever possible.

In order to add evidence sources from the clinical literature, the system provides a search interface to PUBMED[43], enabling publications to be located and their unique PubMed identifiers to be inserted into the system easily and conveniently.

The system is available at http://carre.kmi.open.ac.uk.

3.2. Collecting Private Data

As part of work prescribed in WP4, a dedicated website is under development for collecting private data. This website is going to be built on the principles of Linked Data and will provide a SPARQL endpoint. We have used the progress marked so far to inform the design of the readings ontology.

4. Selected References

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5. Williams, Sandra; Power, Richard and Third, Allan (2014). How easy is it to learn a controlled natural language for building a knowledge base? In: Fourth Workshop on Controlled Natural Language, 20–22 August 2014, Galway, Ireland, Springer International Publishing AG.
6. Semantic Web Authoring Tool. http://swat.open.ac.uk/swat
7. CARRE risk factor knowledge acquisition application. http://carre.kmi.open.ac.uk/
8. BioPortal by the National Center for Biomedical Ontology. http://bioportal.bioontology.org
9. Homepage of the Drupal Content Management System. https://www.drupal.org/
10. PUBMED Webpage. http://www.ncbi.nlm.nih.gov/pubmed

[42] https://www.drupal.org/

[43] http://www.ncbi.nlm.nih.gov/pubmed

Annex 1
Risk Factor Ontology

1. Source code for the ontology editor

```
%risk element
A risk element is a document.
A risk element has risk element name a risk element name.
A risk element name is a <xsd:string>.
A risk element has educational material an educational material identifier.
A risk element has risk element observable at least one observable.
A risk element has risk element type a risk element type.
A risk element has risk element modifiable status a boolean.
A boolean is a <xsd:boolean>.

A disorder risk element is a risk element.
An intervention risk element is a risk element.
An environmental risk element is a risk element.
A demographic risk element is a risk element.
A behavioural risk element is a risk element.
A genetic risk element is a risk element.

A risk element has risk element identifier a risk element identifier.
Anything that something has risk element identifier is a risk element identifier.

A disorder risk element has risk element identifier a disorder identifier.
A disorder identifier is an icd10code or an icd9code or a snomedctcode.
An icd10code is a P00ToP96 or a A00ToB99 or a Q00ToQ99 or a D50ToD89 or a I00ToI99 or a K00ToK93 or a H60ToH95 or a H00ToH59 or a N00ToN99 or a M00ToM99 or a J00ToJ99 or a L00ToL99 or a L00ToL99 or a E00ToE90 or a V01ToY98 or a Z00ToZ99 or a S00ToT98 or a F00ToF99 or a C00ToD48 or a O00ToO99 or a R00ToR99.

P00ToP96 is a <http://purl.bioontology.org/ontology/ICD10/P00-P96.9>.
A00ToB99 is a <http://purl.bioontology.org/ontology/ICD10/A00-B99.9>.
Q00ToQ99 is a <http://purl.bioontology.org/ontology/ICD10/Q00-Q99.9>.
D50ToD89 is a <http://purl.bioontology.org/ontology/ICD10/D50-D89.9>.
I00ToI99 is a <http://purl.bioontology.org/ontology/ICD10/I00-I99.9>.
K00ToK93 is a <http://purl.bioontology.org/ontology/ICD10/K00-K93.9>.
H60ToH95 is a <http://purl.bioontology.org/ontology/ICD10/H60-H95.9>.
H00ToH59 is a <http://purl.bioontology.org/ontology/ICD10/H00-H59.9>.
N00ToN99 is a <http://purl.bioontology.org/ontology/ICD10/N00-N99.9>.
M00ToM99 is a <http://purl.bioontology.org/ontology/ICD10/M00-M99.9>.
J00ToJ99 is a <http://purl.bioontology.org/ontology/ICD10/G00-G99.9>.
L00ToL99 is a <http://purl.bioontology.org/ontology/ICD10/J00-J99.9>.
L00ToL99 is a <http://purl.bioontology.org/ontology/ICD10/L00-L99.9>.
E00ToE90 is a <http://purl.bioontology.org/ontology/ICD10/E00-E90.9>.
V01ToY98 is a <http://purl.bioontology.org/ontology/ICD10/V01-Y98.9>.
Z00ToZ99 is a <http://purl.bioontology.org/ontology/ICD10/Z00-Z99.9>.
S00ToT98 is a <http://purl.bioontology.org/ontology/ICD10/S00-T98.9>.
F00ToF99 is a <http://purl.bioontology.org/ontology/ICD10/F00-F99.9>.
C00ToD48 is a <http://purl.bioontology.org/ontology/ICD10/C00-D48.9>.
O00ToO99 is a <http://purl.bioontology.org/ontology/ICD10/O00-O99.9>.
R00ToR99 is a <http://purl.bioontology.org/ontology/ICD10/R00-R99.9>.

A icd9code is a <http://purl.bioontology.org/ontology/ICD9CM/001-999.99>.
A snomedctcode is a <http://purl.bioontology.org/ontology/SNOMEDCT/404684003>.

An intervention risk element has risk element identifier an intervention identifier.
An intervention identifier is a <http://purl.bioontology.org/ontology/ICD10PCS/0>.
An environmental risk element has risk element identifier an environmental identifier.
A demographic risk element has a demographic identifier or a umlscode.
```

A demographic identifier is an hl7 identifier or a gender identifier or an age identifier or a string.
A string is a <xsd:string>.
An hl7 identifier is a <http://purl.bioontology.org/ontology/HL7/C1561446>.
A gender identifier is a <http://xmlns.com/foaf/0.1/gender>.
An age identifier is a <http://xmlns.com/foaf/0.1/age>.
A behavioural risk element has risk element identifier a behavioural identifier.
A behavioural identifier is a <xsd:string> or a umlscode.
A genetic risk element has risk element identifier a genetic identifier.
A genetic identifier is a <xsd:string> or a umlscode.

A umlscode is a <xsd:string>.

A risk element identifier is a disorder identifier or an intervention identifier or an environmental identifier or a demographic identifier or a behavioural identifier or a genetic identifier.

% observable
An observable is a document.
An observable has observable name a name.
An observable has educational material an educational material identifier.
An observable has observable measurement at least one measurement value.
An observable has observable maximum normal value an observable maximum normal value.
An observable has observable minimum normal value an observable minimum normal value.
An observable maximum normal value is an observable normal value.
An observable minimum normal value is an observable normal value.
An observable normal value is a measurement value.

An educational material identifier is a <http://purl.bioontology.org/ontology/MEDLINEPLUS/C1456590>.

%risk factor
A risk factor is a document.
A risk factor has risk factor source at least one risk element.
A risk factor has risk factor target at least one risk element.
A risk factor has risk factor association type an association type.
An assocation type has as type "causes" or has as type "issues in".
A risk factor has risk evidence at least one risk evidence.
A risk factor has risk factor aggregate probability a real number.

%risk evidence
A risk evidence has risk evidence observable at least one observable.
A risk evidence has observable expression an observable expression.
An observable expression is an <xsd:string>.
A risk evidence has risk evidence ratio value a ratio value.
A ratio value is a number.
A ratio value is a relative ratio or a hazard ratio.
A ratio value has confidence interval a confidence interval.
A confidence interval is a real number.
A confidence interval has maximum value 1.
A confidence interval has minimum value 0.
A ratio value is adjusted for an adjustment factor.
An adjustment factor is an <xsd:string>.
A risk evidence has risk evidence source a citation.

%citation
A citation has citation pubmed identifier a pubmed identifier.
A pubmed identifier is a <http://bio2rdf.org/pubmed_vocabulary:PubMedRecord>.
A citation has citation evidence source type a source type.
A citation has citation evidence source level a source level.

%document superclass
A document has author a person.
A document has author an author.
A document has reviewer a person.
A document is a risk factor or a risk element or an observable.

A person is a <http://xmlns.com/foaf/0.1/Person>.
An author is a <http://purl.org/dc/elements/1.1/creator>

Anything that something has risk evidence ratio value is a ratio value.
A real number is a number.
Anything that something has observable maximum normal value is an observable maximum normal value.
Anything that something has risk element type is a risk element type.
Anything that something has confidence interval is a confidence interval.
Anything that something has observable minimum normal value is an observable minimum normal value.
Anything that something has risk factor association type is an association type.
Anything that something has citation pubmed identifier is a pubmed identifier.
Anything that something has risk factor source is a risk element.
Anything that something has risk factor target is a risk element.
Anything that something has risk evidence source is a citation.
Anything that something has citation evidence source level is an evidence source level.
Anything that something has citation evidence source type is an evidence source type.
Anything that something has risk element identifier is a disorder identifier or an intervention identifier or an environmental identifier or a demographic identifier or a behavioural identifier or a genetic identifier.
Anything that something has an observable measurement is an measurement value.
Anything that something has risk element observable is an observable.
Anything that something has risk evidence is a risk evidence.
Anything that something has is adjusted for is a an adjustment factor.
A UMLScode is a <umls:CUI>

A risk element identifier is a disorder identifier or an intervention identifier or an environmental identifier or a demographic identifier or a behavioural identifier or a genetic identifier.

% observable
An observable has observable name a name.
An observable has educational material an educational material identifier.
An observable has observable measurement at least one measurement value.
An observable has observable maximum normal value an observable maximum normal value.
An observable has observable minimum normal value an observable minimum normal value.
An observable maximum normal value is an observable normal value.
An observable minimum normal value is an observable normal value.
An observable normal value is a measurement value.

An educational material identifier is a <http://purl.bioontology.org/ontology/MEDLINEPLUS/C1456590>.

%risk factor
A risk factor has risk factor source at least one risk element.
A risk factor has risk factor target at least one risk element.
A risk factor has risk factor association type an association type.
An assocation type has as type "causes" or has as type "issues in".
A risk factor has risk evidence at least one risk evidence.
A risk factor has risk factor aggregate probability a real number.

%risk evidence
A risk evidence has risk evidence observable at least one observable.
A risk evidence has observable expression an observable expression.
An observable expression is an <xsd:string>.
A risk evidence has risk evidence ratio value a ratio value.

A ratio value is a number.
A ratio value is a relative ratio or a hazard ratio.
A ratio value has confidence interval a confidence interval.
A confidence interval is a real number.
A confidence interval has maximum value 1.
A confidence interval has minimum value 0.
A ratio value is adjusted for an adjustment factor.
An adjustment factor is an <xsd:string>.
A risk evidence has risk evidence source a citation.

%citation
A citation has citation pubmed identifier a pubmed identifier.
A pubmed identifier is a <http://bio2rdf.org/pubmed_vocabulary:PubMedRecord>.
A citation has citation evidence source type a source type.
A citation has citation evidence source level a source level.

Anything that something has risk evidence ratio value is a ratio value.
A real number is a number.
Anything that something has observable maximum normal value is an observable maximum normal value.
Anything that something has risk element type is a risk element type.
Anything that something has confidence interval is a confidence interval.
Anything that something has observable minimum normal value is an observable minimum normal value.
Anything that something has risk factor association type is an association type.
Anything that something has citation pubmed identifier is a pubmed identifier.
Anything that something has risk factor source is a risk element.
Anything that something has risk factor target is a risk element.
Anything that something has risk evidence source is a citation.
Anything that something has citation evidence source level is an evidence source level.
Anything that something has citation evidence source type is an evidence source type.
Anything that something has risk element identifier is a disorder identifier or an intervention identifier or an environmental identifier or a demographic identifier or a behavioural identifier or a genetic identifier.
Anything that something has an observable measurement is an measurement value.
Anything that something has risk element observable is an observable.
Anything that something has risk evidence is a risk evidence.
Anything that something has is adjusted for is a an adjustment factor.

2. Manchester OWL syntax

Prefix: owl: <http://www.w3.org/2002/07/owl#>

Prefix: rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

Prefix: xml: <http://www.w3.org/XML/1998/namespace>

Prefix: xsd: <http://www.w3.org/2001/XMLSchema#>

Prefix: rdfs: <http://www.w3.org/2000/01/rdf-schema#>

Ontology: <http://carre.kmi.open.ac.uk/ontology/risk.owl>

```
AnnotationProperty: <http://www.swatproject.org/dataProperty>

AnnotationProperty: <http://www.swatproject.org/objectProperty>

AnnotationProperty: <http://www.swatproject.org/class>

Datatype: rdf:PlainLiteral

Datatype: xsd:string

Datatype: xsd:integer

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_modifiable_status>
    Annotations:
        <http://www.swatproject.org/objectProperty> "has risk element modifiable status"


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence>

    Annotations:
        <http://www.swatproject.org/objectProperty> "has risk evidence"

    Range:
        <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_evidence>


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#is_adjusted_for>

    Annotations:
        <http://www.swatproject.org/objectProperty> "is adjusted for"


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_name>

    Annotations:
        <http://www.swatproject.org/objectProperty> "has observable name"


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence_source>
```

Annotations:
<http://www.swatproject.org/objectProperty> "has risk evidence source"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#citation>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_target>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk factor target"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_minimum_normal_value>

Annotations:
<http://www.swatproject.org/objectProperty> "has observable minimum normal value"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_minimum_normal_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_expression>

Annotations:
<http://www.swatproject.org/objectProperty> "has observable expression"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence_ratio_value>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk evidence ratio value"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#ratio_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_citation_evidence_source_level>

Annotations:
<http://www.swatproject.org/objectProperty> "has citation evidence source level"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#evidence_source_level>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_association_type>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk factor association type"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#association_type>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_educational_material>

Annotations:
<http://www.swatproject.org/objectProperty> "has educational material"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_source>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk factor source"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_name>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk element name"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_measurement>

Annotations:
<http://www.swatproject.org/objectProperty> "has observable measurement"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_citation_pubmed_identifier>

Annotations:
<http://www.swatproject.org/objectProperty> "has citation pubmed identifier"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#pubmed_identifier>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_aggregate_probability>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk factor aggregate probability"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_observable>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk element observable"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#observable>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_citation_evidence_source_type>

Annotations:
<http://www.swatproject.org/objectProperty> "has citation evidence source type"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#evidence_source_type>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence_observable>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk evidence observable"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_reviewer>

Annotations:
<http://www.swatproject.org/objectProperty> "has reviewer"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_confidence_interval>

Annotations:
<http://www.swatproject.org/objectProperty> "has confidence interval"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#confidence_interval>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_type>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk element type"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_type>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier>

Annotations:
<http://www.swatproject.org/objectProperty> "has risk element identifier"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_identifier>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_author>

Annotations:
<http://www.swatproject.org/objectProperty> "has author"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_maximum_normal_value>

Annotations:
<http://www.swatproject.org/objectProperty> "has observable maximum normal value"

Range:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_maximum_normal_value>

DataProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_as_type>

Annotations:
<http://www.swatproject.org/dataProperty> "has as type"

DataProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_maximum_value>

Annotations:
<http://www.swatproject.org/dataProperty> "has maximum value"

DataProperty: <http://carre.kmi.open.ac.uk/ontology/risk.owl#has_minimum_value>

Annotations:
<http://www.swatproject.org/dataProperty> "has minimum value"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#A00ToB99>

Annotations:
<http://www.swatproject.org/class> "A00ToB99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_factor>

Annotations:

<http://www.swatproject.org/class> "risk factor"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence> min 1 <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_evidence>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#document>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_association_type> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#association_type>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_target> min 1 <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_source> min 1 <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_factor_aggregate_probability> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#real_number>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>

Annotations:

<http://www.swatproject.org/class> "risk element"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_observable> min 1 <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#document>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_modifiable_status> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#boolean>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_educational_material> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#educational_material_identifier>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_type> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_type>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_name> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_name>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_identifier>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#pubmed_identifier>

Annotations:
<http://www.swatproject.org/class> "pubmed identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_name>

Annotations:
<http://www.swatproject.org/class> "risk element name"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#S00ToT98>

Annotations:
<http://www.swatproject.org/class> "S00ToT98"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#boolean>

Annotations:
<http://www.swatproject.org/class> "boolean"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#H60ToH95>

Annotations:
<http://www.swatproject.org/class> "H60ToH95"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#D50ToD89>

Annotations:
<http://www.swatproject.org/class> "D50ToD89"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#genetic_identifier>

Annotations:

<http://www.swatproject.org/class> "genetic identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#adjustment_factor>

Annotations:

<http://www.swatproject.org/class> "adjustment factor"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#measurement_value>

Annotations:

<http://www.swatproject.org/class> "measurement value"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#number>

Annotations:

<http://www.swatproject.org/class> "number"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#gender_identifier>

Annotations:

<http://www.swatproject.org/class> "gender identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#intervention_risk_element>

Annotations:

<http://www.swatproject.org/class> "intervention risk element"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#intervention_identifier>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#assocation_type>

Annotations:
<http://www.swatproject.org/class> "assocation type"

SubClassOf:
(<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_as_type> value "causes"^^xsd:string)
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_as_type> value "issues in"^^xsd:string)

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#disorder_risk_element>

Annotations:
<http://www.swatproject.org/class> "disorder risk element"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>,
<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#disorder_identifier>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#icd9code>

Annotations:
<http://www.swatproject.org/class> "icd9code"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#association_type>

Annotations:
<http://www.swatproject.org/class> "association type"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#intervention_identifier>

Annotations:
<http://www.swatproject.org/class> "intervention identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#behavioural_identifier>

Annotations:
<http://www.swatproject.org/class> "behavioural identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#confidence_interval>

Annotations:
<http://www.swatproject.org/class> "confidence interval"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_minimum_value> value 0,
<http://carre.kmi.open.ac.uk/ontology/risk.owl#real_number>,
<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_maximum_value> value 1

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_type>

Annotations:
<http://www.swatproject.org/class> "risk element type"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#disorder_identifier>

Annotations:
<http://www.swatproject.org/class> "disorder identifier"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#icd10code>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#icd9code>
or <http://carre.kmi.open.ac.uk/ontology/risk.owl#snomedctcode>)

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#C00ToD48>

Annotations:
<http://www.swatproject.org/class> "C00ToD48"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#behavioural_risk_element>

Annotations:

<http://www.swatproject.org/class> "behavioural risk element"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#behavioural_identifier>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_maximum_normal_value>

Annotations:

<http://www.swatproject.org/class> "observable maximum normal value"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_normal_value>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#age_identifier>

Annotations:

<http://www.swatproject.org/class> "age identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#genetic_risk_element>

Annotations:

<http://www.swatproject.org/class> "genetic risk element"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#genetic_identifier>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#M00ToM99>

Annotations:
<http://www.swatproject.org/class> "M00ToM99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#author>

Annotations:
<http://www.swatproject.org/class> "author"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#R00ToR99>

Annotations:
<http://www.swatproject.org/class> "R00ToR99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#icd10code>

Annotations:
<http://www.swatproject.org/class> "icd10code"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#P00ToP96>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#A00ToB99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#Q00ToQ99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#D50ToD89>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#I00ToI99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#K00ToK93>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#H60ToH95>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#H00ToH59>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#N00ToN99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#M00ToM99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#J00ToJ99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#L00ToL99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#L00ToL99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#E00ToE90>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#V01ToY98>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#Z00ToZ99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#S00ToT98>

or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#F00ToF99>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#C00ToD48>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#O00ToO99>
or <http://carre.kmi.open.ac.uk/ontology/risk.owl#R00ToR99>)))))))))))))))))))

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#name>

Annotations:
<http://www.swatproject.org/class> "name"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#J00ToJ99>

Annotations:
<http://www.swatproject.org/class> "J00ToJ99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#O00ToO99>

Annotations:
<http://www.swatproject.org/class> "O00ToO99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#E00ToE90>

Annotations:
<http://www.swatproject.org/class> "E00ToE90"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#snomedctcode>

Annotations:
<http://www.swatproject.org/class> "snomedctcode"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#F00ToF99>

Annotations:

<http://www.swatproject.org/class> "F00ToF99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#educational_material_identifier>

Annotations:

<http://www.swatproject.org/class> "educational material identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#P00ToP96>

Annotations:

<http://www.swatproject.org/class> "P00ToP96"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#source_level>

Annotations:

<http://www.swatproject.org/class> "source level"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_evidence>

Annotations:

<http://www.swatproject.org/class> "risk evidence"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence_ratio_value> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#ratio_value>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_expression> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_expression>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence_source> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#citation>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_evidence_observable> min 1 <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_expression>

Annotations:

<http://www.swatproject.org/class> "observable expression"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#person>

Annotations:
<http://www.swatproject.org/class> "person"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#K00ToK93>

Annotations:
<http://www.swatproject.org/class> "K00ToK93"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#evidence_source_level>

Annotations:
<http://www.swatproject.org/class> "evidence source level"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#H00ToH59>

Annotations:
<http://www.swatproject.org/class> "H00ToH59"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#Z00ToZ99>

Annotations:
<http://www.swatproject.org/class> "Z00ToZ99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#source_type>

Annotations:
<http://www.swatproject.org/class> "source type"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#demographic_risk_element>

Annotations:

<http://www.swatproject.org/class> "demographic risk element"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#citation>

Annotations:

<http://www.swatproject.org/class> "citation"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_citation_evidence_source_type> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#source_type>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_citation_pubmed_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#pubmed_identifier>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_citation_evidence_source_level> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#source_level>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#N00ToN99>

Annotations:

<http://www.swatproject.org/class> "N00ToN99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#Q00ToQ99>

Annotations:

<http://www.swatproject.org/class> "Q00ToQ99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#environmental_identifier>

Annotations:

<http://www.swatproject.org/class> "environmental identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#V01ToY98>

Annotations:

<http://www.swatproject.org/class> "V01ToY98"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#I00ToI99>

Annotations:

<http://www.swatproject.org/class> "I00ToI99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#L00ToL99>

Annotations:

<http://www.swatproject.org/class> "L00ToL99"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#ratio_value>

Annotations:

<http://www.swatproject.org/class> "ratio value"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#is_adjusted_for> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#adjustment_factor>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#hazard_ratio>

or <http://carre.kmi.open.ac.uk/ontology/risk.owl#relative_ratio>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#number>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_confidence_interval> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#confidence_interval>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#hl7_identifier>

Annotations:

<http://www.swatproject.org/class> "hl7 identifier"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_normal_value>

Annotations:
<http://www.swatproject.org/class> "observable normal value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#measurement_value>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#demographic_identifier>

Annotations:
<http://www.swatproject.org/class> "demographic identifier"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#hl7_identifier>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#gender_identifier>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#age_identifier>
or <http://carre.kmi.open.ac.uk/ontology/risk.owl#string>))

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element_identifier>

Annotations:
<http://www.swatproject.org/class> "risk element identifier"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/risk.owl#disorder_identifier>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#intervention_identifier>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#environmental_identifier>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#demographic_identifier>
or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#behavioural_identifier>
or <http://carre.kmi.open.ac.uk/ontology/risk.owl#genetic_identifier>))))

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#hazard_ratio>

Annotations:

<http://www.swatproject.org/class> "hazard ratio"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#evidence_source_type>

Annotations:

<http://www.swatproject.org/class> "evidence source type"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#environmental_risk_element>

Annotations:

<http://www.swatproject.org/class> "environmental risk element"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_risk_element_identifier> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#environmental_identifier>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#string>

Annotations:

<http://www.swatproject.org/class> "string"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#relative_ratio>

Annotations:

<http://www.swatproject.org/class> "relative ratio"

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_minimum_normal_value>

Annotations:

<http://www.swatproject.org/class> "observable minimum normal value"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_normal_value>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#document>

Annotations:

<http://www.swatproject.org/class> "document"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_reviewer> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#person>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_factor>

or (<http://carre.kmi.open.ac.uk/ontology/risk.owl#observable>

or <http://carre.kmi.open.ac.uk/ontology/risk.owl#risk_element>),

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_author> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#author>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_author> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#person>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable>

Annotations:

<http://www.swatproject.org/class> "observable"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_maximum_normal_value> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_maximum_normal_value>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_measurement> min 1 <http://carre.kmi.open.ac.uk/ontology/risk.owl#measurement_value>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_name> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#name>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#document>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_observable_minimum_normal_value> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#observable_minimum_normal_value>,

<http://carre.kmi.open.ac.uk/ontology/risk.owl#has_educational_material> some <http://carre.kmi.open.ac.uk/ontology/risk.owl#educational_material_identifier>

Class: <http://carre.kmi.open.ac.uk/ontology/risk.owl#real_number>

Annotations:

<http://www.swatproject.org/class> "real number"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/risk.owl#number>

3. Output of SWAT ontology documentation generator

A00TO B99 (class)

Other — No information.

ADJUSTMENT FACTOR (class)

Other — No information.

AGE IDENTIFIER (class)

Other — No information.

ASSOCATION TYPE (class)

Description — An assocation type has as type causes, or has as type issues in.

ASSOCIATION TYPE (class)

Description — If X has as risk factor association type Y then Y is an association type.

AUTHOR (class)

Other — No information.

BEHAVIOURAL IDENTIFIER (class)

Other — No information.

BEHAVIOURAL RISK ELEMENT (class)

Typology — A behavioural risk element is a risk element.

Description — A behavioural risk element has as risk element identifier a behavioural identifier.

BOOLEAN (class)

Other — No information.

C00TO D48 (class)

Other — No information.

CITATION (class)

Description — A citation has as citation pubmed identifier a pubmed identifier, has as citation evidence source type a source type, and has as citation evidence source level a source level.
If X has as risk evidence source Y then Y is a citation.

CONFIDENCE INTERVAL (class)

Typology — A confidence interval is a real number.

Description — A confidence interval both has as minimum value 0, and has as maximum value 1.
If X has as confidence interval Y then Y is a confidence interval.

D50TO D89 (class)

Other — No information.

DEMOGRAPHIC IDENTIFIER (class)

Description — A demographic identifier is a hl7 identifier, or is a gender identifier, or is

an age identifier, or is a string.

DEMOGRAPHIC RISK ELEMENT (class)

Typology: A demographic risk element is a risk element.

DISORDER IDENTIFIER (class)

Description: A disorder identifier is an icd10code, or is an icd9code, or is a snomedctcode.

DISORDER RISK ELEMENT (class)

Typology: A disorder risk element is a risk element.

Description: A disorder risk element has as risk element identifier a disorder identifier.

DOCUMENT (class)

Description: A document has as reviewer a person, has as author a person, and has as author an author.
A document is a risk factor, or is an observable, or is a risk element.

Examples: The following are documents: risk factors, risk elements, and observables.

E00TO E90 (class)

Other: No information.

EDUCATIONAL MATERIAL IDENTIFIER (class)

Other: No information.

ENVIRONMENTAL IDENTIFIER (class)

Other: No information.

ENVIRONMENTAL RISK ELEMENT (class)

Typology: An environmental risk element is a risk element.

Description: An environmental risk element has as risk element identifier an environmental identifier.

EVIDENCE SOURCE LEVEL (class)

Description: If X has as citation evidence source level Y then Y is an evidence source level.

EVIDENCE SOURCE TYPE (class)

Description: If X has as citation evidence source type Y then Y is an evidence source type.

F00TO F99 (class)

Other: No information.

GENDER IDENTIFIER (class)

Other: No information.

GENETIC IDENTIFIER (class)

Other: No information.

GENETIC RISK ELEMENT (class)

Typology: A genetic risk element is a risk element.

Description A genetic risk element has as risk element identifier a genetic identifier.

H00TO H59 (class)
Other No information.

H60TO H95 (class)
Other No information.

HAS AS AUTHOR (object property)
Other No information.

HAS AS CITATION EVIDENCE SOURCE LEVEL (object property)
Description If X has as citation evidence source level Y then Y is an evidence source level.

HAS AS CITATION EVIDENCE SOURCE TYPE (object property)
Description If X has as citation evidence source type Y then Y is an evidence source type.

HAS AS CITATION PUBMED IDENTIFIER (object property)
Description If X has as citation pubmed identifier Y then Y is a pubmed identifier.

HAS AS CONFIDENCE INTERVAL (object property)
Description If X has as confidence interval Y then Y is a confidence interval.

HAS AS EDUCATIONAL MATERIAL (object property)
Other No information.

HAS AS MAXIMUM VALUE (data property)
Other No information.

HAS AS MINIMUM VALUE (data property)
Other No information.

HAS AS OBSERVABLE EXPRESSION (object property)
Other No information.

HAS AS OBSERVABLE MAXIMUM NORMAL VALUE (object property)
Description If X has as observable maximum normal value Y then Y is an observable maximum normal value.

HAS AS OBSERVABLE MEASUREMENT (object property)
Other No information.

HAS AS OBSERVABLE MINIMUM NORMAL VALUE (object property)
Description If X has as observable minimum normal value Y then Y is an observable minimum normal value.

HAS AS OBSERVABLE NAME (object property)
Other No information.

HAS AS REVIEWER (object property)

Other No information.

HAS AS RISK ELEMENT IDENTIFIER (object property)
Description If X has as risk element identifier Y then Y is a risk element identifier.

HAS AS RISK ELEMENT MODIFIABLE STATUS (object property)
Other No information.

HAS AS RISK ELEMENT NAME (object property)
Other No information.

HAS AS RISK ELEMENT OBSERVABLE (object property)
Description If X has as risk element observable Y then Y is an observable.

HAS AS RISK ELEMENT TYPE (object property)
Description If X has as risk element type Y then Y is a risk element type.

HAS AS RISK EVIDENCE (object property)
Description If X has as risk evidence Y then Y is a risk evidence.

HAS AS RISK EVIDENCE OBSERVABLE (object property)
Other No information.

HAS AS RISK EVIDENCE RATIO VALUE (object property)
Description If X has as risk evidence ratio value Y then Y is a ratio value.

HAS AS RISK EVIDENCE SOURCE (object property)
Description If X has as risk evidence source Y then Y is a citation.

HAS AS RISK FACTOR AGGREGATE PROBABILITY (object property)
Other No information.

HAS AS RISK FACTOR ASSOCIATION TYPE (object property)
Description If X has as risk factor association type Y then Y is an association type.

HAS AS RISK FACTOR SOURCE (object property)
Description If X has as risk factor source Y then Y is a risk element.

HAS AS RISK FACTOR TARGET (object property)
Description If X has as risk factor target Y then Y is a risk element.

HAS AS TYPE (data property)
Other No information.

HAZARD RATIO (class)
Other No information.

HL7 IDENTIFIER (class)
Other No information.

I00TO I99 (class)

Other No information.

ICD10CODE (class)

Description An icd10code is a p00to p96, or is an a00to b99, or is a g00to q99, or is a d50to d89, or is an i00to i99, or is a k00to k93, or is a h60to h95, or is a h00to h59, or is a n00to n99, or is a m00to m99, or is a j00to j99, or is a l00to l99, or is a l00to l99, or is an e00to e90, or is a v01to y98, or is a z00to z99, or is a s00to t98, or is a f00to f99, or is a c00to d48, or is an o00to o99, or is a r00to r99.

ICD9CODE (class)

Other No information.

INTERVENTION IDENTIFIER (class)

Other No information.

INTERVENTION RISK ELEMENT (class)

Typology An intervention risk element is a risk element.

Description An intervention risk element has as risk element identifier an intervention identifier.

IS ADJUSTED FOR (object property)

Other No information.

J00TO J99 (class)

Other No information.

K00TO K93 (class)

Other No information.

L00TO L99 (class)

Other No information.

M00TO M99 (class)

Other No information.

MEASUREMENT VALUE (class)

Examples An observable normal value is a measurement value.

N00TO N99 (class)

Other No information.

NAME (class)

Other No information.

NUMBER (class)

Examples Real numbers, and ratio values are numbers.

O00TO O99 (class)

Other No information.

OBSERVABLE (class)

Typology An observable is a document.

Description An observable has as observable name a name, has as observable

minimum normal value an observable minimum normal value, has as observable maximum normal value an observable maximum normal value, andhas as educational material an educational material identifier.
An observable has as observable measurement at least one measurement value.
If X has as risk element observable Y then Y is an observable.

OBSERVABLE EXPRESSION (class)

Other: No information.

OBSERVABLE MAXIMUM NORMAL VALUE (class)

Typology: An observable maximum normal value is an observable normal value.

Description: If X has as observable maximum normal value Y then Y is an observable maximum normal value.

OBSERVABLE MINIMUM NORMAL VALUE (class)

Typology: An observable minimum normal value is an observable normal value.

Description: If X has as observable minimum normal value Y then Y is an observable minimum normal value.

OBSERVABLE NORMAL VALUE (class)

Typology: An observable normal value is a measurement value.

Examples: Observable minimum normal values, and observable maximum normal values are observable normal values.

P00TO P96 (class)

Other: No information.

PERSON (class)

Other: No information.

PUBMED IDENTIFIER (class)

Description: If X has as citation pubmed identifier Y then Y is a pubmed identifier.

Q00TO Q99 (class)

Other: No information.

R00TO R99 (class)

Other: No information.

RATIO VALUE (class)

Typology: A ratio value is a number.

Description: A ratio value both is adjusted for an adjustment factor, and has as confidence interval a confidence interval.
A ratio value is a hazard ratio, or is a relative ratio.
If X has as risk evidence ratio value Y then Y is a ratio value.

REAL NUMBER (class)

Typology: A real number is a number.

Examples: A confidence interval is a real number.

RELATIVE RATIO (class)

Other — No information.

RISK ELEMENT (class)

Typology — A risk element is a document.

Description — A risk element has as risk element type a risk element type, has as risk element name a risk element name, has as risk element modifiable status a boolean, has as risk element identifier a risk element identifier, andhas as educational material an educational material identifier.
If any of the following relationships hold between X and Y then Y is a risk element: "has as risk factor target" and "has as risk factor source".
A risk element has as risk element observable at least one observable.

Examples — The following are risk elements: intervention risk elements, genetic risk elements and environmental risk elements, and so on (6 items in total).

RISK ELEMENT IDENTIFIER (class)

Description — A risk element identifier is a disorder identifier, or is an intervention identifier, or is an environmental identifier, or is a demographic identifier, or is a behavioural identifier, or is a genetic identifier.
If X has as risk element identifier Y then Y is a risk element identifier.

RISK ELEMENT NAME (class)

Other — No information.

RISK ELEMENT TYPE (class)

Description — If X has as risk element type Y then Y is a risk element type.

RISK EVIDENCE (class)

Description — A risk evidence has as risk evidence source a citation, has as risk evidence ratio value a ratio value, and has as observable expression an observable expression.
A risk evidence has as risk evidence observable at least one observable.
If X has as risk evidence Y then Y is a risk evidence.

RISK FACTOR (class)

Typology — A risk factor is a document.

Description — A risk factor has as risk factor target at least one risk element, has as risk factor source at least one risk element, and has as risk evidence at least one risk evidence.
A risk factor both has as risk factor association type an association type, and has as risk factor aggregate probability a real number.

S00TO T98 (class)

Other — No information.

SNOMEDCTCODE (class)

Other — No information.

SOURCE LEVEL (class)

Other — No information.

SOURCE TYPE (class)

Other — No information.

STRING (class)

Other No information.

V01TO Y98 (class)

Other No information.

Z00TO Z99 (class)

Other No information.

Annex 2
Readings & Measurements Ontology

1. Source code of the ontology editor

```
A user has user identifier a string.

A user is a <http://purl.org/cpr/0.9#patient>.
A user is a <http://xmlns.com/foaf/0.1/Person>.

%Accounts & authentication.
An user has connection a connection.
A connection has manufacturer a manufacturer.
A manufacturer has manufacturer name a string.
A manufacturer has manufacturer website a website.
A website is a <xsd:anyURI>.
%Withings  Fitbit IHealth are manufacturers.
A connection has user id a string.
A connection has access token a string.
A connection has as access token secret a string.
A connection has as request token a string.
A connection has as request token secret a string.
A connection has as expiry a long.
A connection has as refresh token a string.


A individual reading is measured by a manufacturer.
Anything that something is measured by is a manufacturer.
Anything that is measured by something is a individual reading.

%A individual reading has metric type a metric type.
%Anything that something has metric type is a metric type.
%Anything that has metric type something is a individual reading.

Anything that something has date is a date.
Anything that something has provenance is a string.

A individual reading has date a date.

Anything that has actuality something is a individual reading.
Anything that something has actuality is a string.

Anything that has note something is a individual reading.
Anything that something has note is a string.

A longitude value has measurement type a longitude.
A longitude is a <http://www.w3.org/2003/01/geo/wgs84_pos#long>.
A longitude value has datatype a float.
A longitude value has unit a degrees unit.
A degrees unit is a <http://purl.obolibrary.org/obo/UO_0000185>.
A longitude value has label "degrees longitude".
Anything that something has longitude is a individual reading.
Anything that has longitude something is a individual reading.


A latitude value has measurement type a latitude.
A latitude is a <http://www.w3.org/2003/01/geo/wgs84_pos#lat>.
A latitude value has datatype a float.
A latitude value has unit a degrees unit.
A latitude value has label "degrees latitude".
Anything that something has latitude is a individual reading.
```

Anything that has latitude something is a individual reading.

% measurement value
A measurement value has datatype a datatype.
A measurement value has unit a unit.
A measurement value has measurement type a measurement type.

%Anything that has metric type something is a individual reading.
%Anything that something has metric type is a metric type.

A steps value has measurement type a distance moved by unspecified means.
A steps value has datatype an int.
A steps value has label "steps".
A steps value has unit a count unit.
A count unit is a <http://purl.obolibrary.org/obo/UO_0000189>.
Anything that something has steps is a steps value.
Anything that has steps something is an individual activity measurement.

A distance value has measurement type a distance moved by unspecified means.
A distance value has datatype a float.
A distance value has label "km".
A distance value has unit a kilometer unit.
A kilometer unit is a <http://purl.obolibrary.org/obo/UO_1000008>.
Anything that something has distance is a distance value.
Anything that has distance something is an individual activity measurement.

A calories metabolised value has measurement type a calories metabolised value measurement type.
A calories metabolised value measurement type is a <http://purl.bioontology.org/ontology/LNC/LP35952-8>.
A calories metabolised value has datatype a float.
A calories metabolised value has label "calories".
A calories metabolised value has unit a calorie unit.
A calorie unit is a <http://qudt.org/vocab/unit#CalorieNutritional>.
Anything that something has calories metabolised is a calories metabolised value.
Anything that has calories metabolised something is an individual activity measurement.

Anything that something has calories b m r is a calories metabolised value.
Anything that has calories b m r something is an individual activity measurement.

Anything that something has activity calories is a calories metabolised value.
Anything that has activity calories something is an individual activity measurement.

Anything that something has marginal calories is a calories metabolised value.
Anything that has marginal calories something is an individual activity measurement.

A elevation value has measurement type a distance moved by unspecified means.
An elevation value has datatype a float.
An elevation value has label "elevation".
An elevation value has unit a kilometer unit.
Anything that something has elevation is an elevation value.
Anything that has elevation something is an individual activity measurement.

%voluntary locomotion measurement (needs subclassing).
A distance moved by unspecified means is a <http://purl.obolibrary.org/obo/CMO_0000955>.

A floors value has measurement type a distance moved by unspecified means.
A floors value has datatype an int.
A floors value has label "floors".

A floors value has unit a count unit.
Anything that something has floors is a floors value.
Anything that has floors something is an individual activity measurement.

A duration is a <http://www.w3.org/2006/time#Interval>.
A duration value has measurement type a duration.
A duration value has datatype a long.
A duration value has label "seconds".
A duration value has unit a seconds unit.
A seconds unit is a <http://purl.obolibrary.org/obo/UO_0000010>.
Anything that something has duration value is a duration value.

Anything that something has sedentary activity duration is a duration value.
Anything that has sedentary activity duration something is an individual activity measurement.

Anything that something has light activity duration is a duration.
Anything that has light activity duration something is an individual activity measurement.

Anything that something has moderate activity duration is a duration value.
Anything that has moderate activity duration something is an individual activity measurement.

Anything that something has intense activity duration is a duration value.
Anything that has intense activity duration something is an individual activity measurement.

Anything that something has sedentary activity distance is a distance moved by unspecified means.
Anything that has sedentary activity distance something is an individual activity measurement.

Anything that something has light activity distance is a distance moved by unspecified means.
Anything that has light activity distance something is an individual activity measurement.

Anything that something has moderate activity distance is a distance moved by unspecified means.
Anything that has moderate activity distance something is an individual activity measurement.

Anything that something has intense activity distance is a distance moved.
Anything that has intense activity distance something is an individual activity measurement.

Anything that something has logged activity distance is a distance moved by unspecified means.
Anything that has logged activity distance something is an individual activity measurement.

Anything that something has tracked activity distance is a distance moved by unspecified means.
Anything that has tracked activity distance something is an individual activity measurement.

Anything that something has logged activity duration is a duration value.
Anything that has logged activity duration something is an individual activity measurement.

A logged activity name value has measurement type a logged activity.
A logged activity name value has datatype a string.
A logged activity name has unit a dimensionless unit.
A logged activity name value has label "logged activity name".
Anything that something has logged activity name is a logged activity name value.
Anything that has logged activity name something is an individual activity measurement.

A timezone value has measurement type a timezone value measurement type
A timezone value measurement type is a <http://www.w3.org/2006/timezone#TimeZone>.
A timezone value has datatype a string.
A timezone value has label "timezone".
A timezone value has unit a dimensionless unit.
Anything that something has timezone is a timezone value.

Anything that has timezone something is an individual activity measurement.

A bicep value has measurement type a bicep value measurement type
A bicep value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000317>.
A bicep value has datatype a double.
A bicep value has label "bicep".
A bicep value has unit a centimeter unit.
A centimeter unit is a <http://purl.obolibrary.org/obo/UO_0000015>.
Anything that something has bicep is a bicep value.
Anything that has bicep something is an individual body measurement.

A calf value has measurement type a calf value measurement type
A calf value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000186>.
A calf value has datatype a double.
A calf value has label "calf".
A calf value has unit a centimeter unit.
Anything that something has calf is a calf value.
Anything that has calf something is an individual body measurement.

A chest value has measurement type a chest value measurement type
A chest value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000316>.
A chest value has datatype a double.
A chest value has label "chest".
A chest value has unit a centimeter unit.
Anything that something has chest is a chest value.
Anything that has chest something is an individual body measurement.

A forearm value has measurement type a forearm value measurement type
A forearm value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000187>.
A forearm value has datatype a double.
A forearm value has label "forearm".
A forearm value has unit a centimeter unit.
Anything that something has forearm is a forearm value.
Anything that has forearm something is an individual body measurement.

A hips value has measurement type a hips value measurement type
A hips value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000014>.
A hips value has datatype a double.
A hips value has label "hips".
A hips value has unit a centimeter unit.
Anything that something has hips is a hips value.
Anything that has hips something is an individual body measurement.

A neck value has measurement type a neck value measurement type.
A neck value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000021>.
A neck value has datatype a double.
A neck value has label "neck".
A neck value has unit a centimeter unit.
Anything that something has neck is a neck value.
Anything that has neck something is an individual body measurement.

A thigh value has measurement type a thigh value measurement type
A thigh value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000019>.
A thigh value has datatype a double.
A thigh value has label "thigh".
A thigh value has unit a centimeter unit.
Anything that something has thigh is a thigh value.
Anything that has thigh something is an individual body measurement.

A waist value has measurement type a waist value measurement type
A waist value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000242>.
A waist value has datatype a double.
A waist value has label "waist".
A waist value has unit a centimeter unit.
Anything that something has waist is a waist value.
Anything that has waist something is an individual body measurement.

A calories value has measurement type a calories value measurement type
A calories value measurement type is a <http://purl.obolibrary.org/obo/CMO_0002208>.
A calories value has datatype a double.
A calories value has label "calories".
A calories value has unit a calorie unit.
Anything that something has calories is a calories value.
Anything that has calories something is an individual food measurement.

An unspecified nutrition value is a <http://purl.obolibrary.org/obo/CMO_0002210>.

A carbs value has measurement type an carbohydrates nutrition value.
A carbs value has datatype a double.
A carbs value has label "carbs".
A carbs value has unit a grams value.
A grams value is a <http://purl.obolibrary.org/obo/UO_0000021>.
Anything that something has carbs is a carbs value.
Anything that has carbs something is an individual food measurement.

A nutritional fat value has measurement type an fat nutrition value.
A nutritional fat value has datatype a double.
A nutritional fat value has label "fat".
A nutritional fat value has unit a grams value.
Anything that something has nutritional fat is a nutritional fat value.
Anything that has nutritional fat something is an individual food measurement.

A fibre value has measurement type an fibre nutrition value.
A fibre value has datatype a double.
A fibre value has label "fibre".
A fibre value has unit a grams value.
Anything that something has fibre is a fibre value.
Anything that has fibre something is an individual food measurement.

A protein value has measurement type an protein nutrition value.
A protein value has datatype a double.
A protein value has label "protein".
A protein value has unit a grams value.
Anything that something has protein is a protein value.
Anything that has protein something is an individual food measurement.

A sodium value has measurement type an sodium nutrition value.
A sodium value has datatype a double.
A sodium value has label "sodium".
A sodium value has unit a grams value.
Anything that something has sodium is a sodium value.
Anything that has sodium something is an individual food measurement.

A water value has measurement type a water value measurement type
A water value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000774>.
A water value has datatype a double.
A water value has label "water".
A water value has unit a liter value.

A liter value is a <http://purl.obolibrary.org/obo/UO_0000099>.
Anything that something has water is a water value.
Anything that has water something is an individual food measurement.

A food quantity value has measurement type a food quantity.
A food quantity value has datatype a double.
A food quantity value has label "food quantity".
A food quantity value has unit a grams value.
Anything that something has quantity double is a food quantity value.
Anything that has food quantity something is an individual food measurement.

A food type value has measurement type a food type.
A food type value has datatype a string.
A food type value has label "food type".
A food type value has unit a dimensionless unit.
Anything that something has food type is a food type value.
Anything that has food type something is an individual food measurement.

A meal type value has measurement type a meal type.
A meal type value has datatype a string.
A meal type value has label "meal type".
A meal type value has unit a dimensionless unit.
Anything that something has meal type is a meal type value.
Anything that has meal type something is an individual food measurement.

A glucose value has measurement type a glucose value measurement type
A glucose value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000046>.
A glucose value has datatype a double.
A glucose value has label "glucose".
A glucose value has unit a millimole per liter unit.
Anything that something has glucose is a glucose value.
Anything that has glucose something is an individual glucose measurement.

A hba1c value has measurement type a hba1c value measurement type
A hba1c value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000508>.
A hba1c value has datatype a double.
A hba1c value has label "hba1c".
A hba1c value has unit a millimole per mole unit.
Anything that something has hba1c is a hba1c value.
Anything that has hba1c something is an individual glucose measurement.

A dinner situation value has measurement type a dinner situation.
A dinner situation value has datatype a string.
A dinner situation value has label "dinner situation".
A dinner situatoin value has unit a dimensionless unit.
Anything that something has dinner situation is a dinner situation value.
Anything that has dinner situation something is an individual glucose measurement.

A drug situation value has measurement type a drug situation.
A drug situation value has datatype a string.
A drug situation value has label "drug situation".
A drug situation value has unit a dimensionless unit.
Anything that something has drug situation is a drug situation value.
Anything that has drug situation something is an individual glucose measurement.

A height value has measurement type a height value measurement type
A height value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000106>.
A height value has datatype a double.
A height value has label "height".

A height value has unit a centimeter unit.
Anything that something has height is a height value.
Anything that has height something is an individual height measurement.

A pulse value has measurement type a pulse value measurement type
A pulse value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000294>.
A pulse value has datatype a long.
A pulse value has unit a count per minute unit.
A count per minute unit is a <http://purl.obolibrary.org/obo/UO_0000148>.
A pulse value has label "pulse".
Anything that something has pulse is a pulse value.
Anything that has pulse something is an individual pulse measurement.

An arrhythmia value has measurement type a device manufacturer calculated arrhythmia.
An arrhythmia value has datatype a string.
An arrhythmia value has label "arrhythmia".
An arrhythmia value has unit a dimensionless unit.
Anything that something has arrhythmia is an arrhythmia value.
Anything that has arrhythmia something is an individual pulse measurement.

A condition value has measurement type a device manufacturer calculated pulse condition.
A condition value has datatype a string.
A condition value has label "condition".
A condition value has unit a dimensionless unit.
Anything that something has condition is a condition value.
Anything that has condition something is an individual pulse measurement.

An individual sleep measurement has sleep record at least one sleep record.

A times rem asleep value has measurement type an occurrence count.
A times rem asleep value has datatype a long.
A times rem asleep value has label "times rem asleep".
A times rem asleep value has unit a count unit.
Anything that something has times rem asleep is a times rem asleep value.
Anything that has times rem asleep something is an individual sleep measurement.

A times deeply asleep value has measurement type an occurrence count.
A times deeply asleep value has datatype a long.
A times deeply asleep value has label "times deeply asleep".
A times deeply asleep value has unit a count unit.
Anything that something has times deeply asleep is a times deeply asleep value.
Anything that has times deeply asleep something is an individual sleep measurement.

A times lightly asleep value has measurement type an occurrence count.
A times lightly asleep value has datatype a long.
A times lightly asleep value has label "times lightly asleep".
A times lightly asleep value has unit a count unit.
Anything that something has times lightly asleep is a times lightly asleep value.
Anything that has times lightly asleep something is an individual sleep measurement.

A times awake value has measurement type an occurrence count.
A times awake value has datatype a long.
A times awake value has label "times awake".
A times awake value has unit a count unit.
Anything that something has times awake is a times awake value.
Anything that has times awake something is an individual sleep measurement.

A times restless value has measurement type an occurrence count.

A times restless value has datatype a long.
A times restless value has label "times restless".
A times restless value has unit a count unit.
Anything that something has times restless is a times restless value.
Anything that has times restless something is an individual sleep measurement.

A time to fall asleep value is a duration value.
A time to fall asleep value has label "time to fall asleep".
Anything that something has time to fall asleep is a time to fall asleep value.
Anything that has time to fall asleep something is an individual sleep measurement.

A sleep time value is a duration value.
A sleep time value has label "sleep time".
Anything that something has sleep time is a sleep time value.
Anything that has sleep time something is an individual sleep measurement.

A sleep efficiency value has measurement type a device manufacturer calculated sleep efficiency.
A sleep efficiency value has datatype a double.
A sleep efficiency value has label "sleep efficiency".
A sleep efficiency value has unit a percentage unit.
A percentage unit is a <http://purl.obolibrary.org/obo/UO_0000187>.
Anything that something has sleep efficiency is a sleep efficiency value.
Anything that has sleep efficiency something is an individual sleep measurement.

An awake duration value is a duration value.
An awake duration value has label "awake duration".
Anything that something has awake duration is an awake duration value.
Anything that has awake duration something is an individual sleep measurement.

An asleep duration value is a duration value.
An asleep duration value has label "asleep duration".
Anything that something has asleep duration is an asleep duration value.
Anything that has asleep duration something is an individual sleep measurement.

A restless duration value is a duration value.
A restless duration value has label "restless duration".
Anything that something has restless duration is a restless duration value.
Anything that has restless duration something is an individual sleep measurement.

A rem duration value is a duration value.
A rem duration value has label "rem duration".
Anything that something has rem duration is a rem duration value.
Anything that has rem duration something is an individual sleep measurement.

A deep sleep duration value is a duration value.
A deep sleep duration value has label "deep sleep duration".
Anything that something has deep sleep duration is a deep sleep duration value.
Anything that has deep sleep duration something is an individual sleep measurement.

A light sleep duration value is a duration value.
A light sleep duration value has label "light sleep duration".
Anything that something has light sleep duration is a light sleep duration value.
Anything that has light sleep duration something is an individual sleep measurement.

A time after wakeup value is a duration value.
A time after wakeup value has label "time after wakeup".
Anything that something has time after wakeup is a time after wakeup value.
Anything that has time after wakeup something is an individual sleep measurement.

A morning time value has measurement type a time.
A morning time value has datatype a date.
A morning time value has label "morning time".
A morning time value has unit a date unit.
Anything that something has morning time is a morning time value.
Anything that has morning time something is an individual sleep measurement.

A weight value has measurement type a weight value measurement type
A weight value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000012>.
A weight value has datatype a double.
A weight value has label "weight".
A weight value has unit a kilogram unit.
A kilogram unit is a <http://purl.obolibrary.org/obo/UO_0000009>.
Anything that something has weight is a weight value.
Anything that has weight something is an individual weight measurement.

A bmi value has measurement type a bmi value measurement type
A bmi value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000105>.
A bmi value has datatype a double.
A bmi value has label "bmi".
A bmi value has unit a kilogram per square meter unit.
A kilogram per square meter unit is a <http://purl.obolibrary.org/obo/UO_0000086>.
Anything that something has bmi is a bmi value.
Anything that has bmi something is an individual weight measurement.

A body fat value has measurement type a body fat value measurement type
A body fat value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000302>.
A body fat value has datatype a double.
A body fat value has label "body fat".
A body fat value has unit a mass percentage unit.
A mass percentage unit is a <http://purl.obolibrary.org/obo/UO_0000163>.
Anything that something has body fat is a body fat value.
Anything that has body fat something is an individual weight measurement.

A lean mass value has measurement type a calculated whole body lean mass measurement.
A calculated whole body lean mass measurement is a <http://purl.obolibrary.org/obo/CMO_0002184>.
A lean mass value has datatype a double.
A lean mass value has label "lean mass".
A lean mass value has unit a kilogram unit.
Anything that something has lean mass is a lean mass value.
Anything that has lean mass something is an individual weight measurement.

A muscle mass value has measurement type a muscle mass value measurement type
A muscle mass value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000448>.
A muscle mass value has datatype a double.
A muscle mass value has label "muscle mass".
A muscle mass value has unit a kilogram unit.
Anything that something has muscle mass is a muscle mass value.
Anything that has muscle mass something is an individual weight measurement.

A water mass value has measurement type a calculated whole body water measurement.
A calculated whole body water measurement is a <http://purl.obolibrary.org/obo/CMO_0000000>.
A water mass value has datatype a double.
A water mass value has label "water mass".
A water mass value has unit a kilogram unit.
Anything that something has water mass is a water mass value.
Anything that has water mass something is an individual weight measurement.

A fat mass value has measurement type a fat mass value measurement type

A fat mass value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000305>.
A fat mass value has datatype a double.
A fat mass value has label "fat mass".
A fat mass value has unit a kilogram unit.
Anything that something has fat mass is a fat mass value.
Anything that has fat mass something is an individual weight measurement.

A bone mass value has measurement type a bone mass value measurement type
A bone mass value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000461>.
A bone mass value has datatype a double.
A bone mass value has label "bone mass".
A bone mass value has unit a kilogram unit.
Anything that something has bone mass is a bone mass value.
Anything that has bone mass something is an individual weight measurement.

A body dci value has measurement type a body dci value measurement type
A body dci value measurement type is a <http://purl.obolibrary.org/obo/CMO_0002253>.
A body dci value has datatype a double.
A body dci value has label "body daily calorie intake".
A body dci value has unit a calorie unit.
Anything that something has body dci is a body dci value.
Anything that has body dci something is an individual weight measurement.

A blood pressure systolic value has measurement type a blood pressure systolic value measurement type.
A blood pressure systolic value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000004>.
A blood pressure systolic value has datatype an integer.
A blood pressure systolic value has label "mmHg (systolic)".
A blood pressure systolic value has unit a millimeters of mercury unit.
A millimeters of mercury unit is a <http://purl.obolibrary.org/obo/UO_0000272>.
Anything that something has blood pressure systolic is a blood pressure systolic value.
Anything that has blood pressure systolic something is an individual blood pressure measurement.

A blood pressure diastolic value has measurement type a blood pressure diastolic value measurement type.
A blood pressure diastolic value measurement type is a <http://purl.obolibrary.org/obo/CMO_0000005>.
A blood pressure diastolic value has datatype an integer.
A blood pressure diastolic value has label "mmHg (diastolic)".
A blood pressure diastolic value has unit a millimeters of mercury unit.
Anything that something has blood pressure diastolic is a blood pressure diastolic value.
Anything that has blood pressure diastolic something is an individual blood pressure measurement.

An individual activity measurement is a individual reading.
An individual body measurement is a individual reading.
An individual food measurement is a individual reading.
An individual glucose measurement is a individual reading.
An individual height measurement is a individual reading.
An individual pulse measurement is a individual reading.
An individual sleep measurement is a individual reading.
An individual weight measurement is a individual reading.
An individual blood pressure is a individual reading.

2. Manchester OWL syntax

Prefix: owl: <http://www.w3.org/2002/07/owl#>

```
Prefix: rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
Prefix: xml: <http://www.w3.org/XML/1998/namespace>
Prefix: xsd: <http://www.w3.org/2001/XMLSchema#>
Prefix: rdfs: <http://www.w3.org/2000/01/rdf-schema#>



Ontology: <http://carre.kmi.open.ac.uk/ontology/sensors.owl>


AnnotationProperty: <http://www.swatproject.org/dataProperty>


AnnotationProperty: <http://www.swatproject.org/objectProperty>


AnnotationProperty: <http://www.swatproject.org/class>


Datatype: rdf:PlainLiteral


Datatype: xsd:string


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sodium>

    Annotations:
        <http://www.swatproject.org/objectProperty> "has sodium"

    Domain:
        <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

    Range:
        <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sodium_value>


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_provenance>

    Annotations:
        <http://www.swatproject.org/objectProperty> "has provenance"

    Range:
        <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype>

    Annotations:
        <http://www.swatproject.org/objectProperty> "has datatype"


ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_longitude>

    Annotations:
        <http://www.swatproject.org/objectProperty> "has longitude"

    Domain:
        <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>
```

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_times_deeply_asleep>

Annotations:
<http://www.swatproject.org/objectProperty> "has times deeply asleep"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_deeply_asleep_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_dinner_situation>

Annotations:
<http://www.swatproject.org/objectProperty> "has dinner situation"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_glucose_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#dinner_situation_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_expiry>

Annotations:
<http://www.swatproject.org/objectProperty> "has as expiry"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_asleep_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has asleep duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#asleep_duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sedentary_activity_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has sedentary activity distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_light_activity_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has light activity distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_manufacturer_website>

Annotations:
<http://www.swatproject.org/objectProperty> "has manufacturer website"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#is_measured_by>

Annotations:
<http://www.swatproject.org/objectProperty> "is measured by"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#manufacturer>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sleep_record>

Annotations:
<http://www.swatproject.org/objectProperty> "has sleep record"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_times_restless>

Annotations:
<http://www.swatproject.org/objectProperty> "has times restless"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_restless_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_light_activity_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has light activity duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_height>

Annotations:
<http://www.swatproject.org/objectProperty> "has height"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_height_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#height_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type>

Annotations:
<http://www.swatproject.org/objectProperty> "has measurement type"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_hips>

Annotations:
<http://www.swatproject.org/objectProperty> "has hips"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#hips_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_intense_activity_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has intense activity distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_logged_activity_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has logged activity distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_duration_value>

Annotations:
<http://www.swatproject.org/objectProperty> "has duration value"

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_bicep>

Annotations:
<http://www.swatproject.org/objectProperty> "has bicep"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#bicep_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_date>

Annotations:
<http://www.swatproject.org/objectProperty> "has date"

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#date>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_steps>

Annotations:
<http://www.swatproject.org/objectProperty> "has steps"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#steps_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_refresh_token>

Annotations:
<http://www.swatproject.org/objectProperty> "has as refresh token"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_nutritional_fat>

Annotations:
<http://www.swatproject.org/objectProperty> "has nutritional fat"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#nutritional_fat_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_intense_activity_duration>

Annotations:

<http://www.swatproject.org/objectProperty> "has intense activity duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_water_mass>

Annotations:
<http://www.swatproject.org/objectProperty> "has water mass"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#water_mass_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_forearm>

Annotations:
<http://www.swatproject.org/objectProperty> "has forearm"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#forearm_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_calories>

Annotations:
<http://www.swatproject.org/objectProperty> "has calories"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_arrhythmia>

Annotations:
<http://www.swatproject.org/objectProperty> "has arrhythmia"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_pulse_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#arrhythmia_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_tracked_activity_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has tracked activity distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_time_after_wakeup>

Annotations:
<http://www.swatproject.org/objectProperty> "has time after wakeup"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#time_after_wakeup_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_access_token>

Annotations:
<http://www.swatproject.org/objectProperty> "has access token"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_calf>

Annotations:
<http://www.swatproject.org/objectProperty> "has calf"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calf_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_quantity_double>

Annotations:
<http://www.swatproject.org/objectProperty> "has quantity double"

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_quantity_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_fibre>

Annotations:
<http://www.swatproject.org/objectProperty> "has fibre"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#fibre_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_morning_time>

Annotations:
<http://www.swatproject.org/objectProperty> "has morning time"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#morning_time_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_rem_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has rem duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#rem_duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_glucose>

Annotations:
<http://www.swatproject.org/objectProperty> "has glucose"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_glucose_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#glucose_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_activity_calories>

Annotations:
<http://www.swatproject.org/objectProperty> "has activity calories"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_weight>

Annotations:
<http://www.swatproject.org/objectProperty> "has weight"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#weight_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_manufacturer_name>

Annotations:
<http://www.swatproject.org/objectProperty> "has manufacturer name"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_logged_activity_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has logged activity duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_request_token_secret>

Annotations:
<http://www.swatproject.org/objectProperty> "has as request token secret"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_pulse>

Annotations:
<http://www.swatproject.org/objectProperty> "has pulse"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_pulse_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#pulse_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_user_id>

Annotations:
<http://www.swatproject.org/objectProperty> "has user id"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_blood_pressure_diastolic>

Annotations:
<http://www.swatproject.org/objectProperty> "has blood pressure diastolic"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_blood_pressure_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_diastolic_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_chest>

Annotations:
<http://www.swatproject.org/objectProperty> "has chest"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#chest_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_connection>

Annotations:
<http://www.swatproject.org/objectProperty> "has connection"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_times_rem_asleep>

Annotations:
<http://www.swatproject.org/objectProperty> "has times rem asleep"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_rem_asleep_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_marginal_calories>

Annotations:
<http://www.swatproject.org/objectProperty> "has marginal calories"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_fat_mass>

Annotations:
<http://www.swatproject.org/objectProperty> "has fat mass"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#fat_mass_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_waist>

Annotations:
<http://www.swatproject.org/objectProperty> "has waist"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#waist_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_neck>

Annotations:
<http://www.swatproject.org/objectProperty> "has neck"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#neck_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_drug_situation>

Annotations:
<http://www.swatproject.org/objectProperty> "has drug situation"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_glucose_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#drug_situation_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_awake_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has awake duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#awake_duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_body_fat>

Annotations:
<http://www.swatproject.org/objectProperty> "has body fat"

Domain:

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#body_fat_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_food_quantity>

Annotations:
<http://www.swatproject.org/objectProperty> "has food quantity"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_muscle_mass>

Annotations:
<http://www.swatproject.org/objectProperty> "has muscle mass"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#muscle_mass_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_times_awake>

Annotations:
<http://www.swatproject.org/objectProperty> "has times awake"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_awake_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sleep_time>

Annotations:
<http://www.swatproject.org/objectProperty> "has sleep time"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#sleep_time_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_actuality>

Annotations:
<http://www.swatproject.org/objectProperty> "has actuality"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_calories_metabolised>

Annotations:
<http://www.swatproject.org/objectProperty> "has calories metabolised"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_water>

Annotations:
<http://www.swatproject.org/objectProperty> "has water"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#water_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_light_sleep_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has light sleep duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#light_sleep_duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_deep_sleep_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has deep sleep duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#deep_sleep_duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_latitude>

Annotations:
<http://www.swatproject.org/objectProperty> "has latitude"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_carbs>

Annotations:
<http://www.swatproject.org/objectProperty> "has carbs"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#carbs_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_bone_mass>

Annotations:
<http://www.swatproject.org/objectProperty> "has bone mass"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#bone_mass_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_protein>

Annotations:
<http://www.swatproject.org/objectProperty> "has protein"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#protein_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_note>

Annotations:
<http://www.swatproject.org/objectProperty> "has note"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_thigh>

Annotations:
<http://www.swatproject.org/objectProperty> "has thigh"

Domain:

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#thigh_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_food_type>

Annotations:
<http://www.swatproject.org/objectProperty> "has food type"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_type_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_restless_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has restless duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#restless_duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_blood_pressure_systolic>

Annotations:
<http://www.swatproject.org/objectProperty> "has blood pressure systolic"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_blood_pressure_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_systolic_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_moderate_activity_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has moderate activity duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_body_dci>

Annotations:
<http://www.swatproject.org/objectProperty> "has body dci"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#body_dci_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_bmi>

Annotations:
<http://www.swatproject.org/objectProperty> "has bmi"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#bmi_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sedentary_activity_duration>

Annotations:
<http://www.swatproject.org/objectProperty> "has sedentary activity duration"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_calories_b_m_r>

Annotations:
<http://www.swatproject.org/objectProperty> "has calories b m r"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_timezone>

Annotations:
<http://www.swatproject.org/objectProperty> "has timezone"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#timezone_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_elevation>

Annotations:
<http://www.swatproject.org/objectProperty> "has elevation"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#elevation_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_condition>

Annotations:
<http://www.swatproject.org/objectProperty> "has condition"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_pulse_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#condition_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_time_to_fall_asleep>

Annotations:
<http://www.swatproject.org/objectProperty> "has time to fall asleep"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#time_to_fall_asleep_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_access_token_secret>

Annotations:
<http://www.swatproject.org/objectProperty> "has as access token secret"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_manufacturer>

Annotations:
<http://www.swatproject.org/objectProperty> "has manufacturer"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sleep_efficiency>

Annotations:
<http://www.swatproject.org/objectProperty> "has sleep efficiency"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#sleep_efficiency_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_request_token>

Annotations:

<http://www.swatproject.org/objectProperty> "has as request token"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_lean_mass>

Annotations:
<http://www.swatproject.org/objectProperty> "has lean mass"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#lean_mass_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_hba1c>

Annotations:
<http://www.swatproject.org/objectProperty> "has hba1c"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_glucose_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#hba1c_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_moderate_activity_distance>

Annotations:
<http://www.swatproject.org/objectProperty> "has moderate activity distance"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_times_lightly_asleep>

Annotations:
<http://www.swatproject.org/objectProperty> "has times lightly asleep"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_lightly_asleep_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_logged_activity_name>

Annotations:
<http://www.swatproject.org/objectProperty> "has logged activity name"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#logged_activity_name_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_meal_type>

Annotations:
<http://www.swatproject.org/objectProperty> "has meal type"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#meal_type_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_floors>

Annotations:
<http://www.swatproject.org/objectProperty> "has floors"

Domain:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

Range:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#floors_value>

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_user_identifier>

Annotations:
<http://www.swatproject.org/objectProperty> "has user identifier"

ObjectProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit>

Annotations:
<http://www.swatproject.org/objectProperty> "has unit"

DataProperty: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label>

Annotations:
<http://www.swatproject.org/dataProperty> "has label"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value>

Annotations:
<http://www.swatproject.org/class> "calories metabolised value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "calories"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value_measurement_type>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calorie_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#float>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_pulse_measurement>

Annotations:
<http://www.swatproject.org/class> "individual pulse measurement"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#waist_value>

Annotations:
<http://www.swatproject.org/class> "waist value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "waist"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>

Annotations:
<http://www.swatproject.org/class> "count unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#carbohydrates_nutrition_value>

Annotations:
<http://www.swatproject.org/class> "carbohydrates nutrition value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#rem_duration_value>

Annotations:
<http://www.swatproject.org/class> "rem duration value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "rem duration"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#drug_situation_value>

Annotations:
<http://www.swatproject.org/class> "drug situation value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "drug situation"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#drug_situation>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>

Annotations:
<http://www.swatproject.org/class> "dimensionless unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sleep_time_value>

Annotations:
<http://www.swatproject.org/class> "sleep time value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "sleep time"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#carbs_value>

Annotations:
<http://www.swatproject.org/class> "carbs value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "carbs"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#carbohydrates_nutrition_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimeter_of_mercury_unit>

Annotations:
<http://www.swatproject.org/class> "millimeter of mercury unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#water_mass_value>

Annotations:
<http://www.swatproject.org/class> "water mass value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calculated_whole_body_water_measurement>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "water mass"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_rem_asleep_value>

Annotations:
<http://www.swatproject.org/class> "times rem asleep value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#occurrence_count>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "times rem asleep"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#bone_mass_value>

Annotations:
<http://www.swatproject.org/class> "bone mass value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "bone mass"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimole_per_mole_unit>

Annotations:
<http://www.swatproject.org/class> "millimole per mole unit"

Class:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#device_manufacturer_calculated_sleep_efficiency>

Annotations:
<http://www.swatproject.org/class> "device manufacturer calculated sleep efficiency"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#weight_value>

Annotations:
<http://www.swatproject.org/class> "weight value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "weight"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#steps_value>

Annotations:
<http://www.swatproject.org/class> "steps value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "steps"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#int>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#time>

  Annotations:
    <http://www.swatproject.org/class> "time"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilometer_unit>

  Annotations:
    <http://www.swatproject.org/class> "kilometer unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#meal_type_value>

  Annotations:
    <http://www.swatproject.org/class> "meal type value"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "meal type"^^xsd:string,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#meal_type>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#glucose_value>

  Annotations:
    <http://www.swatproject.org/class> "glucose value"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "glucose"^^xsd:string,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimole_per_liter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#logged_activity_name>

  Annotations:
    <http://www.swatproject.org/class> "logged activity name"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>

  Annotations:
    <http://www.swatproject.org/class> "double"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_value>

Annotations:
<http://www.swatproject.org/class> "distance value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "km"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilometer_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#float>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#time_after_wakeup_value>

Annotations:
<http://www.swatproject.org/class> "time after wakeup value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "time after wakeup"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_per_square_meter_unit>

Annotations:
<http://www.swatproject.org/class> "kilogram per square meter unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#liter_value>

Annotations:
<http://www.swatproject.org/class> "liter value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#meal_type>

Annotations:
<http://www.swatproject.org/class> "meal type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_quantity>

Annotations:
<http://www.swatproject.org/class> "food quantity"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#neck_value>

Annotations:
<http://www.swatproject.org/class> "neck value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "neck"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#neck_value_measurement_type>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_food_measurement>

  Annotations:
    <http://www.swatproject.org/class> "individual food measurement"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_lightly_asleep_value>

  Annotations:
    <http://www.swatproject.org/class> "times lightly asleep value"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#occurrence_count>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>,
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "times lightly asleep"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#date_unit>

  Annotations:
    <http://www.swatproject.org/class> "date unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_activity_measurement>

  Annotations:
    <http://www.swatproject.org/class> "individual activity measurement"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#longitude>

  Annotations:
    <http://www.swatproject.org/class> "longitude"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_glucose_measurement>

  Annotations:
    <http://www.swatproject.org/class> "individual glucose measurement"

  SubClassOf:
    <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calf_value>

Annotations:
<http://www.swatproject.org/class> "calf value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "calf"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#body_fat_value>

Annotations:
<http://www.swatproject.org/class> "body fat value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#mass_percentage_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "body fat"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#timezone_value>

Annotations:
<http://www.swatproject.org/class> "timezone value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "timezone"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Annotations:
<http://www.swatproject.org/class> "string"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#float>

Annotations:
<http://www.swatproject.org/class> "float"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#floors_value>

Annotations:
<http://www.swatproject.org/class> "floors value"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#int>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "floors"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#forearm_value>

Annotations:
<http://www.swatproject.org/class> "forearm value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "forearm"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#percentage_unit>

Annotations:
<http://www.swatproject.org/class> "percentage unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#awake_duration_value>

Annotations:
<http://www.swatproject.org/class> "awake duration value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "awake duration"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dinner_situation>

Annotations:
<http://www.swatproject.org/class> "dinner situation"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sodium_value>

Annotations:
<http://www.swatproject.org/class> "sodium value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "sodium"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#sodium_nutrition_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#fat_mass_value>

Annotations:
<http://www.swatproject.org/class> "fat mass value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "fat mass"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#arrhythmia_value>

Annotations:
<http://www.swatproject.org/class> "arrhythmia value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "arrhythmia"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#device_manufacturer_calculated_arrhythmia>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_quantity_value>

Annotations:
<http://www.swatproject.org/class> "food quantity value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_quantity>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "food quantity"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_type_value>

Annotations:
<http://www.swatproject.org/class> "food type value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_type>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "food type"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#website>

Annotations:
<http://www.swatproject.org/class> "website"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#unit>

Annotations:
<http://www.swatproject.org/class> "unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#lean_mass_value>

Annotations:
<http://www.swatproject.org/class> "lean mass value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "lean mass"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calculated_whole_body_lean_mass_measurement>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#logged_activity>

Annotations:
<http://www.swatproject.org/class> "logged activity"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#height_value>

Annotations:
<http://www.swatproject.org/class> "height value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "height"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_blood_pressure_measurement>

Annotations:
<http://www.swatproject.org/class> "individual blood pressure measurement"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#integer>

Annotations:
<http://www.swatproject.org/class> "integer"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#hips_value>

Annotations:
<http://www.swatproject.org/class> "hips value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "hips"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Annotations:
<http://www.swatproject.org/class> "individual reading"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_date> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#date>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#is_measured_by> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#manufacturer>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>

Annotations:
<http://www.swatproject.org/class> "kilogram unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>

Annotations:
<http://www.swatproject.org/class> "long"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#drug_situation>

Annotations:
<http://www.swatproject.org/class> "drug situation"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_value>

Annotations:
<http://www.swatproject.org/class> "calories value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "calories"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calorie_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#fat_nutrition_value>

Annotations:
<http://www.swatproject.org/class> "fat nutrition value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#neck_value_measurement_type>

Annotations:
<http://www.swatproject.org/class> "neck value measurement type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#time_to_fall_asleep_value>

Annotations:
<http://www.swatproject.org/class> "time to fall asleep value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "time to fall asleep"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sleep_efficiency_value>

Annotations:
<http://www.swatproject.org/class> "sleep efficiency value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#device_manufacturer_calculated_sleep_efficiency>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "sleep efficiency"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#percentage_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#muscle_mass_value>

Annotations:
<http://www.swatproject.org/class> "muscle mass value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "muscle mass"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#connection>

Annotations:
<http://www.swatproject.org/class> "connection"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_refresh_token> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_user_id> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_expiry> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_access_token_secret> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_request_token_secret> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_as_request_token> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_manufacturer> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#manufacturer>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_access_token> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calculated_whole_body_lean_mass_measurement>

Annotations:
<http://www.swatproject.org/class> "calculated whole body lean mass measurement"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#food_type>

Annotations:
<http://www.swatproject.org/class> "food type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#body_dci_value>

Annotations:
<http://www.swatproject.org/class> "body dci value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calorie_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "body daily calorie intake"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#manufacturer>

Annotations:
<http://www.swatproject.org/class> "manufacturer"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_manufacturer_website> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#website>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_manufacturer_name> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_blood_pressure>

Annotations:
<http://www.swatproject.org/class> "individual blood pressure"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#protein_nutrition_value>

Annotations:
<http://www.swatproject.org/class> "protein nutrition value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#longitude_value>

Annotations:
<http://www.swatproject.org/class> "longitude value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "degrees longitude"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#degrees_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#float>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#longitude>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#nutritional_fat_value>

Annotations:
<http://www.swatproject.org/class> "nutritional fat value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "fat"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#fat_nutrition_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

Annotations:
<http://www.swatproject.org/class> "distance moved by unspecified means"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#thigh_value>

Annotations:
<http://www.swatproject.org/class> "thigh value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "thigh"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dinner_situation_value>

Annotations:
<http://www.swatproject.org/class> "dinner situation value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "dinner situation"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dinner_situation>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_weight_measurement>

Annotations:
<http://www.swatproject.org/class> "individual weight measurement"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calculated_whole_body_water_measurement>

Annotations:
<http://www.swatproject.org/class> "calculated whole body water measurement"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#logged_activity_name_value>

Annotations:
<http://www.swatproject.org/class> "logged activity name value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#logged_activity>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "logged activity name"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_body_measurement>

Annotations:
<http://www.swatproject.org/class> "individual body measurement"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_systolic_value_measurement_type>

Annotations:
<http://www.swatproject.org/class> "blood pressure systolic value measurement type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#date>

Annotations:
<http://www.swatproject.org/class> "date"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_restless_value>

Annotations:
<http://www.swatproject.org/class> "times restless value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#occurrence_count>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "times restless"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dinner_situatoin_value>

Annotations:
<http://www.swatproject.org/class> "dinner situatoin value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#water_value>

Annotations:
<http://www.swatproject.org/class> "water value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "water"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#liter_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_systolic_value>

Annotations:
<http://www.swatproject.org/class> "blood pressure systolic value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimeter_of_mercury_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "mmHg (systolic)"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#integer>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_systolic_value_measurement_type>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#datatype>

Annotations:
<http://www.swatproject.org/class> "datatype"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#morning_time_value>

Annotations:
<http://www.swatproject.org/class> "morning time value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#date>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#time>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#date_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "morning time"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#bicep_value>

Annotations:
<http://www.swatproject.org/class> "bicep value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "bicep"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#device_manufacturer_calculated_pulse_condition>

Annotations:
<http://www.swatproject.org/class> "device manufacturer calculated pulse condition"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#mass_percentage_unit>

Annotations:
<http://www.swatproject.org/class> "mass percentage unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#fibre_nutrition_value>

Annotations:
<http://www.swatproject.org/class> "fibre nutrition value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#latitude>

Annotations:
<http://www.swatproject.org/class> "latitude"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#deep_sleep_duration_value>

Annotations:
<http://www.swatproject.org/class> "deep sleep duration value"

SubClassOf:

<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "deep sleep duration"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_awake_value>

Annotations:
<http://www.swatproject.org/class> "times awake value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#occurrence_count>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "times awake"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#chest_value>

Annotations:
<http://www.swatproject.org/class> "chest value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "chest"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#measurement_type>

Annotations:
<http://www.swatproject.org/class> "measurement type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_per_minute_unit>

Annotations:
<http://www.swatproject.org/class> "count per minute unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#protein_value>

Annotations:
<http://www.swatproject.org/class> "protein value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#protein_nutrition_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "protein"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>

Class:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#calories_metabolised_value_measurement_type>

Annotations:
<http://www.swatproject.org/class> "calories metabolised value measurement type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#hba1c_value>

Annotations:
<http://www.swatproject.org/class> "hba1c value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "hba1c"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimole_per_mole_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved>

Annotations:
<http://www.swatproject.org/class> "distance moved"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#condition_value>

Annotations:
<http://www.swatproject.org/class> "condition value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#dimensionless_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#device_manufacturer_calculated_pulse_condition>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "condition"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sodium_nutrition_value>

Annotations:
<http://www.swatproject.org/class> "sodium nutrition value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sleep_record>

Annotations:
<http://www.swatproject.org/class> "sleep record"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

Annotations:
<http://www.swatproject.org/class> "duration value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "seconds"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#seconds_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_height_measurement>

Annotations:
<http://www.swatproject.org/class> "individual height measurement"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimole_per_liter_unit>

Annotations:
<http://www.swatproject.org/class> "millimole per liter unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#measurement_value>

Annotations:
<http://www.swatproject.org/class> "measurement value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#datatype>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#measurement_type>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#device_manufacturer_calculated_arrhythmia>

Annotations:
<http://www.swatproject.org/class> "device manufacturer calculated arrhythmia"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_sleep_measurement>

Annotations:
<http://www.swatproject.org/class> "individual sleep measurement"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#individual_reading>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_sleep_record> min 1 <http://carre.kmi.open.ac.uk/ontology/sensors.owl#sleep_record>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#latitude_value>

Annotations:

<http://www.swatproject.org/class> "latitude value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#degrees_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "degrees latitude"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#float>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#latitude>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#asleep_duration_value>

Annotations:
<http://www.swatproject.org/class> "asleep duration value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "asleep duration"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#restless_duration_value>

Annotations:
<http://www.swatproject.org/class> "restless duration value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "restless duration"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#degrees_unit>

Annotations:
<http://www.swatproject.org/class> "degrees unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#user>

Annotations:
<http://www.swatproject.org/class> "user"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_connection> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#connection>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_user_identifier> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#string>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_diastolic_value_measurement_type>

Annotations:
<http://www.swatproject.org/class> "blood pressure diastolic value measurement type"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#calorie_unit>

Annotations:
<http://www.swatproject.org/class> "calorie unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#times_deeply_asleep_value>

Annotations:
<http://www.swatproject.org/class> "times deeply asleep value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#occurrence_count>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "times deeply asleep"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#elevation_value>

Annotations:
<http://www.swatproject.org/class> "elevation value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "elevation"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilometer_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#float>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#distance_moved_by_unspecified_means>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#occurrence_count>

Annotations:
<http://www.swatproject.org/class> "occurrence count"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_diastolic_value>

Annotations:
<http://www.swatproject.org/class> "blood pressure diastolic value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "mmHg (diastolic)"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#blood_pressure_diastolic_value_measurement_type>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#millimeter_of_mercury_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#integer>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#light_sleep_duration_value>

Annotations:

<http://www.swatproject.org/class> "light sleep duration value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "light sleep duration"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#bmi_value>

Annotations:
<http://www.swatproject.org/class> "bmi value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#kilogram_per_square_meter_unit>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "bmi"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#centimeter_unit>

Annotations:
<http://www.swatproject.org/class> "centimeter unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#duration>

Annotations:
<http://www.swatproject.org/class> "duration"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#fibre_value>

Annotations:
<http://www.swatproject.org/class> "fibre value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_measurement_type> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#fibre_nutrition_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#double>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "fibre"^^xsd:string

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#pulse_value>

Annotations:
<http://www.swatproject.org/class> "pulse value"

SubClassOf:
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_datatype> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#long>,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_label> value "pulse"^^xsd:string,
<http://carre.kmi.open.ac.uk/ontology/sensors.owl#has_unit> some <http://carre.kmi.open.ac.uk/ontology/sensors.owl#count_per_minute_unit>

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#seconds_unit>

Annotations:
<http://www.swatproject.org/class> "seconds unit"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#grams_value>

Annotations:
<http://www.swatproject.org/class> "grams value"

Class: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#int>

Annotations:
<http://www.swatproject.org/class> "int"

3. Output of SWAT documentation generator

ARRHYTHMIA VALUE (class)

Description An arrhythmia value has as unit a dimensionless unit, has as measurement type a device manufacturer calculated arrhythmia, and has as datatype a string.

An arrhythmia value has as label arrhythmia.

If X has as arrhythmia Y then Y is an arrhythmia value.

ASLEEP DURATION VALUE (class)

Typology An asleep duration value is a duration value.

Description An asleep duration value has as label asleep duration.

If X has as asleep duration Y then Y is an asleep duration value.

AWAKE DURATION VALUE (class)

Typology An awake duration value is a duration value.

Description An awake duration value has as label awake duration.

If X has as awake duration Y then Y is an awake duration value.

BICEP VALUE (class)

Description A bicep value both has as unit a centimeter unit, and has as datatype a double.

A bicep value has as label bicep.

If X has as bicep Y then Y is a bicep value.

BLOOD PRESSURE DIASTOLIC VALUE (class)

Description A blood pressure diastolic value has as unit a millimeter of mercury unit, has as measurement type a blood pressure diastolic value measurement type, and has as datatype an integer.

A blood pressure diastolic value has as label mmHg (diastolic).

If X has as blood pressure diastolic Y then Y is a blood pressure diastolic value.

BLOOD PRESSURE DIASTOLIC VALUE MEASUREMENT TYPE (class)

Other No information.

BLOOD PRESSURE SYSTOLIC VALUE (class)

Description A blood pressure systolic value has as unit a millimeter of mercury unit, has as measurement type a blood pressure systolic value measurement type, and has as datatype an integer.

A blood pressure systolic value has as label mmHg (systolic).

If X has as blood pressure systolic Y then Y is a blood pressure systolic value.

BLOOD PRESSURE SYSTOLIC VALUE MEASUREMENT TYPE (class)

Other No information.

BMI VALUE (class)

Description A bmi value both has as unit a kilogram per square meter unit, and has as datatype a double.

A bmi value has as label bmi.

If X has as bmi Y then Y is a bmi value.

BODY DCI VALUE (class)

Description A body dci value both has as unit a calorie unit, and has as datatype a double.

A body dci value has as label body daily calorie intake.

If X has as body dci Y then Y is a body dci value.

BODY FAT VALUE (class)

Description A body fat value both has as unit a mass percentage unit, and has as datatype a double.

A body fat value has as label body fat.

If X has as body fat Y then Y is a body fat value.

BONE MASS VALUE (class)

Description A bone mass value both has as unit a kilogram unit, and has as datatype a double.

A bone mass value has as label bone mass.

If X has as bone mass Y then Y is a bone mass value.

CALCULATED WHOLE BODY LEAN MASS MEASUREMENT (class)

Other No information.

CALCULATED WHOLE BODY WATER MEASUREMENT (class)

Other No information.

CALF VALUE (class)

Description A calf value both has as unit a centimeter unit, and has as datatype a double.

A calf value has as label calf.

If X has as calf Y then Y is a calf value.

CALORIE UNIT (class)

Other No information.

CALORIES METABOLISED VALUE (class)

Description If any of the following relationships hold between X and Y then Y is a calories metabolised value: "has as marginal calories", "has as calories metabolised", "has as calories b m r" and "has as activity calories".

A calories metabolised value has as unit a calorie unit, has as measurement type a calories metabolised value measurement type, and has as datatype a float.

A calories metabolised value has as label calories.

CALORIES METABOLISED VALUE MEASUREMENT TYPE (class)

Other No information.

CALORIES VALUE (class)

Description A calories value both has as unit a calorie unit, and has as datatype a double.

A calories value has as label calories.

If X has as calories Y then Y is a calories value.

CARBOHYDRATES NUTRITION VALUE (class)

Other No information.

CARBS VALUE (class)

Description A carbs value has as unit a grams value, has as measurement type a carbohydrates nutrition value, and has as datatype a double.

A carbs value has as label carbs.

If X has as carbs Y then Y is a carbs value.

CENTIMETER UNIT (class)

Other No information.

CHEST VALUE (class)

Description A chest value both has as unit a centimeter unit, and has as datatype a double.

A chest value has as label chest.

If X has as chest Y then Y is a chest value.

CONDITION VALUE (class)

Description A condition value has as unit a dimensionless unit, has as measurement type a device manufacturer calculated pulse condition, and has as datatype a string.

A condition value has as label condition.

If X has as condition Y then Y is a condition value.

CONNECTION (class)

Description A connection has as user id a string, has as manufacturer a manufacturer, has as request token secret a string, has as request token a string, has as refresh token a string, has as expiry a long, has as access token secret a string, and has as access token a string.

COUNT PER MINUTE UNIT (class)

Other No information.

COUNT UNIT (class)

Other No information.

DATATYPE (class)

Other No information.

DATE (class)

Description If X has as date Y then Y is a date.

DATE UNIT (class)

Other No information.

DEEP SLEEP DURATION VALUE (class)

Typology A deep sleep duration value is a duration value.

Description A deep sleep duration value has as label deep sleep duration.

If X has as deep sleep duration Y then Y is a deep sleep duration value.

DEGREES UNIT (class)

Other No information.

DEVICE MANUFACTURER CALCULATED ARRHYTHMIA (class)

Other No information.

DEVICE MANUFACTURER CALCULATED PULSE CONDITION (class)

Other No information.

DEVICE MANUFACTURER CALCULATED SLEEP EFFICIENCY (class)

Other No information.

DIMENSIONLESS UNIT (class)

Other No information.

DINNER SITUATION (class)

Other No information.

DINNER SITUATION VALUE (class)

Description A dinner situation value both has as measurement type a dinner situation, and has as datatype a string.

A dinner situation value has as label dinner situation.

If X has as dinner situation Y then Y is a dinner situation value.

DINNER SITUATOIN VALUE (class)

Description A dinner situatoin value has as unit a dimensionless unit.

DISTANCE MOVED (class)

Description If X has as intense activity distance Y then Y is a distance moved.

DISTANCE MOVED BY UNSPECIFIED MEANS (class)

Description If any of the following relationships hold between X and Y then Y is a distance moved by unspecified means: "has as tracked activity distance", "has as sedentary activity distance", "has as moderate activity distance", "has as logged activity distance" and "has as light activity distance".

DISTANCE VALUE (class)

Description A distance value has as unit a kilometer unit, has as measurement type a distance moved by unspecified means, and has as datatype a float.

A distance value has as label km.

If X has as distance Y then Y is a distance value.

DOUBLE (class)

Other No information.

DRUG SITUATION (class)

Other No information.

DRUG SITUATION VALUE (class)

Description A drug situation value has as unit a dimensionless unit, has as measurement type a drug situation, and has as datatype a string.

A drug situation value has as label drug situation.

If X has as drug situation Y then Y is a drug situation value.

DURATION (class)

Description If X has as light activity duration Y then Y is a duration.

DURATION VALUE (class)

Description If any of the following relationships hold between X and Y then Y is a duration value: "has as sedentary activity duration", "has as moderate activity duration", "has as logged activity duration", "has as intense activity duration" and "has as duration value".

A duration value has as unit a seconds unit, has as measurement type a duration, and has as datatype a long.

A duration value has as label seconds.

Examples The following are duration values: time to fall asleep values, time after wakeup values and sleep time values, and so on (9 items in total).

ELEVATION VALUE (class)

Description An elevation value has as unit a kilometer unit, has as measurement type a distance moved by unspecified means, and has as datatype a float.

An elevation value has as label elevation.

If X has as elevation Y then Y is an elevation value.

FAT MASS VALUE (class)

Description A fat mass value both has as unit a kilogram unit, and has as datatype a double.

A fat mass value has as label fat mass.

If X has as fat mass Y then Y is a fat mass value.

FAT NUTRITION VALUE (class)

Other No information.

FIBRE NUTRITION VALUE (class)

Other No information.

FIBRE VALUE (class)

Description A fibre value has as unit a grams value, has as measurement type a fibre nutrition value, and has as datatype a double.

A fibre value has as label fibre.

If X has as fibre Y then Y is a fibre value.

FLOAT (class)

Other No information.

FLOORS VALUE (class)

Description A floors value has as unit a count unit, has as measurement type a distance

moved by unspecified means, and has as datatype an int.

A floors value has as label floors.

If X has as floors Y then Y is a floors value.

FOOD QUANTITY (class)

Other No information.

FOOD QUANTITY VALUE (class)

Description A food quantity value has as unit a grams value, has as measurement type a food quantity, and has as datatype a double.

A food quantity value has as label food quantity.

If X has as quantity double Y then Y is a food quantity value.

FOOD TYPE (class)

Other No information.

FOOD TYPE VALUE (class)

Description A food type value has as unit a dimensionless unit, has as measurement type a food type, and has as datatype a string.

A food type value has as label food type.

If X has as food type Y then Y is a food type value.

FOREARM VALUE (class)

Description A forearm value both has as unit a centimeter unit, and has as datatype a double.

A forearm value has as label forearm.

If X has as forearm Y then Y is a forearm value.

GLUCOSE VALUE (class)

Description A glucose value both has as unit a millimole per liter unit, and has as datatype a double.

A glucose value has as label glucose.

If X has as glucose Y then Y is a glucose value.

GRAMS VALUE (class)

Other No information.

HAS AS ACCESS TOKEN (object property)

Other No information.

HAS AS ACCESS TOKEN SECRET (object property)

Other No information.

HAS AS ACTIVITY CALORIES (object property)

Description If X has as activity calories Y then Y is a calories metabolised value.

If X has as activity calories Y then X is an individual activity measurement.

HAS AS ACTUALITY (object property)

Description If X has as actuality Y then Y is a string.

If X has as actuality Y then X is an individual reading.

HAS AS ARRHYTHMIA (object property)

Description If X has as arrhythmia Y then Y is an arrhythmia value.

If X has as arrhythmia Y then X is an individual pulse measurement.

HAS AS ASLEEP DURATION (object property)

Description If X has as asleep duration Y then Y is an asleep duration value.

If X has as asleep duration Y then X is an individual sleep measurement.

HAS AS AWAKE DURATION (object property)

Description If X has as awake duration Y then Y is an awake duration value.

If X has as awake duration Y then X is an individual sleep measurement.

HAS AS BICEP (object property)

Description If X has as bicep Y then Y is a bicep value.

If X has as bicep Y then X is an individual body measurement.

HAS AS BLOOD PRESSURE DIASTOLIC (object property)

Description If X has as blood pressure diastolic Y then Y is a blood pressure diastolic value.

If X has as blood pressure diastolic Y then X is an individual blood pressure measurement.

HAS AS BLOOD PRESSURE SYSTOLIC (object property)

Description If X has as blood pressure systolic Y then Y is a blood pressure systolic value.

If X has as blood pressure systolic Y then X is an individual blood pressure measurement.

HAS AS BMI (object property)

Description If X has as bmi Y then Y is a bmi value.

If X has as bmi Y then X is an individual weight measurement.

HAS AS BODY DCI (object property)

Description If X has as body dci Y then Y is a body dci value.

If X has as body dci Y then X is an individual weight measurement.

HAS AS BODY FAT (object property)

Description If X has as body fat Y then Y is a body fat value.

If X has as body fat Y then X is an individual weight measurement.

HAS AS BONE MASS (object property)

Description If X has as bone mass Y then Y is a bone mass value.

If X has as bone mass Y then X is an individual weight measurement.

HAS AS CALF (object property)

Description If X has as calf Y then Y is a calf value.

If X has as calf Y then X is an individual body measurement.

HAS AS CALORIES (object property)

Description If X has as calories Y then Y is a calories value.

If X has as calories Y then X is an individual food measurement.

HAS AS CALORIES B M R (object property)

Description If X has as calories b m r Y then Y is a calories metabolised value.

If X has as calories b m r Y then X is an individual activity measurement.

HAS AS CALORIES METABOLISED (object property)

Description If X has as calories metabolised Y then Y is a calories metabolised value.

If X has as calories metabolised Y then X is an individual activity measurement.

HAS AS CARBS (object property)

Description If X has as carbs Y then Y is a carbs value.

If X has as carbs Y then X is an individual food measurement.

HAS AS CHEST (object property)

Description If X has as chest Y then Y is a chest value.

If X has as chest Y then X is an individual body measurement.

HAS AS CONDITION (object property)

Description If X has as condition Y then Y is a condition value.

If X has as condition Y then X is an individual pulse measurement.

HAS AS CONNECTION (object property)

Other No information.

HAS AS DATATYPE (object property)

Other No information.

HAS AS DATE (object property)

Description If X has as date Y then Y is a date.

HAS AS DEEP SLEEP DURATION (object property)

Description If X has as deep sleep duration Y then Y is a deep sleep duration value.

If X has as deep sleep duration Y then X is an individual sleep measurement.

HAS AS DINNER SITUATION (object property)

Description If X has as dinner situation Y then Y is a dinner situation value.

If X has as dinner situation Y then X is an individual glucose measurement.

HAS AS DISTANCE (object property)

Description If X has as distance Y then Y is a distance value.

If X has as distance Y then X is an individual activity measurement.

HAS AS DRUG SITUATION (object property)

Description If X has as drug situation Y then Y is a drug situation value.

If X has as drug situation Y then X is an individual glucose measurement.

HAS AS DURATION VALUE (object property)

Description If X has as duration value Y then Y is a duration value.

HAS AS ELEVATION (object property)

Description If X has as elevation Y then Y is an elevation value.

If X has as elevation Y then X is an individual activity measurement.

HAS AS EXPIRY (object property)

Other No information.

HAS AS FAT MASS (object property)

Description If X has as fat mass Y then Y is a fat mass value.

If X has as fat mass Y then X is an individual weight measurement.

HAS AS FIBRE (object property)

Description If X has as fibre Y then Y is a fibre value.

If X has as fibre Y then X is an individual food measurement.

HAS AS FLOORS (object property)

Description If X has as floors Y then Y is a floors value.

If X has as floors Y then X is an individual activity measurement.

HAS AS FOOD QUANTITY (object property)

Description If X has as food quantity Y then X is an individual food measurement.

HAS AS FOOD TYPE (object property)

Description If X has as food type Y then Y is a food type value.

If X has as food type Y then X is an individual food measurement.

HAS AS FOREARM (object property)

Description If X has as forearm Y then Y is a forearm value.

If X has as forearm Y then X is an individual body measurement.

HAS AS GLUCOSE (object property)

Description If X has as glucose Y then Y is a glucose value.

If X has as glucose Y then X is an individual glucose measurement.

HAS AS HBA1C (object property)

Description If X has as hba1c Y then Y is a hba1c value.

If X has as hba1c Y then X is an individual glucose measurement.

HAS AS HEIGHT (object property)

Description If X has as height Y then Y is a height value.

If X has as height Y then X is an individual height measurement.

HAS AS HIPS (object property)

Description If X has as hips Y then Y is a hips value.

If X has as hips Y then X is an individual body measurement.

HAS AS INTENSE ACTIVITY DISTANCE (object property)

Description If X has as intense activity distance Y then Y is a distance moved.

If X has as intense activity distance Y then X is an individual activity measurement.

HAS AS INTENSE ACTIVITY DURATION (object property)

Description If X has as intense activity duration Y then Y is a duration value.

If X has as intense activity duration Y then X is an individual activity measurement.

HAS AS LABEL (data property)

Other No information.

HAS AS LATITUDE (object property)

Description If X has as latitude Y then Y is an individual reading.

If X has as latitude Y then X is an individual reading.

HAS AS LEAN MASS (object property)

Description If X has as lean mass Y then Y is a lean mass value.

If X has as lean mass Y then X is an individual weight measurement.

HAS AS LIGHT ACTIVITY DISTANCE (object property)

Description If X has as light activity distance Y then Y is a distance moved by unspecified means.

If X has as light activity distance Y then X is an individual activity measurement.

HAS AS LIGHT ACTIVITY DURATION (object property)

Description If X has as light activity duration Y then Y is a duration.

If X has as light activity duration Y then X is an individual activity measurement.

HAS AS LIGHT SLEEP DURATION (object property)

Description If X has as light sleep duration Y then Y is a light sleep duration value.

If X has as light sleep duration Y then X is an individual sleep measurement.

HAS AS LOGGED ACTIVITY DISTANCE (object property)

Description If X has as logged activity distance Y then Y is a distance moved by unspecified means.

If X has as logged activity distance Y then X is an individual activity measurement.

HAS AS LOGGED ACTIVITY DURATION (object property)

Description If X has as logged activity duration Y then Y is a duration value.

If X has as logged activity duration Y then X is an individual activity measurement.

HAS AS LOGGED ACTIVITY NAME (object property)

Description If X has as logged activity name Y then Y is a logged activity name value.

If X has as logged activity name Y then X is an individual activity measurement.

HAS AS LONGITUDE (object property)

Description If X has as longitude Y then Y is an individual reading.

If X has as longitude Y then X is an individual reading.

HAS AS MANUFACTURER (object property)

Other No information.

HAS AS MANUFACTURER NAME (object property)

Other No information.

HAS AS MANUFACTURER WEBSITE (object property)

Other No information.

HAS AS MARGINAL CALORIES (object property)

Description If X has as marginal calories Y then Y is a calories metabolised value.

If X has as marginal calories Y then X is an individual activity measurement.

HAS AS MEAL TYPE (object property)

Description If X has as meal type Y then Y is a meal type value.

If X has as meal type Y then X is an individual food measurement.

HAS AS MEASUREMENT TYPE (object property)

Other No information.

HAS AS MODERATE ACTIVITY DISTANCE (object property)

Description If X has as moderate activity distance Y then Y is a distance moved by unspecified means.

If X has as moderate activity distance Y then X is an individual activity measurement.

HAS AS MODERATE ACTIVITY DURATION (object property)

Description If X has as moderate activity duration Y then Y is a duration value.

If X has as moderate activity duration Y then X is an individual activity measurement.

HAS AS MORNING TIME (object property)

Description If X has as morning time Y then Y is a morning time value.

If X has as morning time Y then X is an individual sleep measurement.

HAS AS MUSCLE MASS (object property)

Description If X has as muscle mass Y then Y is a muscle mass value.

If X has as muscle mass Y then X is an individual weight measurement.

HAS AS NECK (object property)

Description If X has as neck Y then Y is a neck value.

If X has as neck Y then X is an individual body measurement.

HAS AS NOTE (object property)

Description If X has as note Y then Y is a string.

If X has as note Y then X is an individual reading.

HAS AS NUTRITIONAL FAT (object property)

Description If X has as nutritional fat Y then Y is a nutritional fat value.

If X has as nutritional fat Y then X is an individual food measurement.

HAS AS PROTEIN (object property)

Description If X has as protein Y then Y is a protein value.

If X has as protein Y then X is an individual food measurement.

HAS AS PROVENANCE (object property)

Description If X has as provenance Y then Y is a string.

HAS AS PULSE (object property)

Description If X has as pulse Y then Y is a pulse value.

If X has as pulse Y then X is an individual pulse measurement.

HAS AS QUANTITY DOUBLE (object property)

Description If X has as quantity double Y then Y is a food quantity value.

HAS AS REFRESH TOKEN (object property)

Other No information.

HAS AS REM DURATION (object property)

Description If X has as rem duration Y then Y is a rem duration value.

If X has as rem duration Y then X is an individual sleep measurement.

HAS AS REQUEST TOKEN (object property)

Other No information.

HAS AS REQUEST TOKEN SECRET (object property)

Other No information.

HAS AS RESTLESS DURATION (object property)

Description If X has as restless duration Y then Y is a restless duration value.

If X has as restless duration Y then X is an individual sleep measurement.

HAS AS SEDENTARY ACTIVITY DISTANCE (object property)

Description If X has as sedentary activity distance Y then Y is a distance moved by unspecified means.

If X has as sedentary activity distance Y then X is an individual activity measurement.

HAS AS SEDENTARY ACTIVITY DURATION (object property)

Description If X has as sedentary activity duration Y then Y is a duration value.

If X has as sedentary activity duration Y then X is an individual activity measurement.

HAS AS SLEEP EFFICIENCY (object property)

Description If X has as sleep efficiency Y then Y is a sleep efficiency value.

If X has as sleep efficiency Y then X is an individual sleep measurement.

HAS AS SLEEP RECORD (object property)

Other No information.

HAS AS SLEEP TIME (object property)

Description If X has as sleep time Y then Y is a sleep time value.

If X has as sleep time Y then X is an individual sleep measurement.

HAS AS SODIUM (object property)

Description If X has as sodium Y then Y is a sodium value.

If X has as sodium Y then X is an individual food measurement.

HAS AS STEPS (object property)

Description If X has as steps Y then Y is a steps value.

If X has as steps Y then X is an individual activity measurement.

HAS AS THIGH (object property)

Description If X has as thigh Y then Y is a thigh value.

If X has as thigh Y then X is an individual body measurement.

HAS AS TIME AFTER WAKEUP (object property)

Description If X has as time after wakeup Y then Y is a time after wakeup value.

If X has as time after wakeup Y then X is an individual sleep measurement.

HAS AS TIME TO FALL ASLEEP (object property)

Description If X has as time to fall asleep Y then Y is a time to fall asleep value.

If X has as time to fall asleep Y then X is an individual sleep measurement.

HAS AS TIMES AWAKE (object property)

Description If X has as times awake Y then Y is a times awake value.

If X has as times awake Y then X is an individual sleep measurement.

HAS AS TIMES DEEPLY ASLEEP (object property)

Description If X has as times deeply asleep Y then Y is a times deeply asleep value.

If X has as times deeply asleep Y then X is an individual sleep measurement.

HAS AS TIMES LIGHTLY ASLEEP (object property)

Description If X has as times lightly asleep Y then Y is a times lightly asleep value.

If X has as times lightly asleep Y then X is an individual sleep measurement.

HAS AS TIMES REM ASLEEP (object property)

Description If X has as times rem asleep Y then Y is a times rem asleep value.

If X has as times rem asleep Y then X is an individual sleep measurement.

HAS AS TIMES RESTLESS (object property)

Description If X has as times restless Y then Y is a times restless value.

If X has as times restless Y then X is an individual sleep measurement.

HAS AS TIMEZONE (object property)

Description If X has as timezone Y then Y is a timezone value.

If X has as timezone Y then X is an individual activity measurement.

HAS AS TRACKED ACTIVITY DISTANCE (object property)

Description If X has as tracked activity distance Y then Y is a distance moved by unspecified means.

If X has as tracked activity distance Y then X is an individual activity measurement.

HAS AS UNIT (object property)

Other No information.

HAS AS USER ID (object property)

Other No information.

HAS AS USER IDENTIFIER (object property)

Other No information.

HAS AS WAIST (object property)

Description If X has as waist Y then Y is a waist value.

If X has as waist Y then X is an individual body measurement.

HAS AS WATER (object property)

Description If X has as water Y then Y is a water value.

If X has as water Y then X is an individual food measurement.

HAS AS WATER MASS (object property)

Description If X has as water mass Y then Y is a water mass value.

If X has as water mass Y then X is an individual weight measurement.

HAS AS WEIGHT (object property)

Description If X has as weight Y then Y is a weight value.

If X has as weight Y then X is an individual weight measurement.

HBA1C VALUE (class)

Description A hba1c value both has as unit a millimole per mole unit, and has as datatype a double.

A hba1c value has as label hba1c.

If X has as hba1c Y then Y is a hba1c value.

HEIGHT VALUE (class)

Description A height value both has as unit a centimeter unit, and has as datatype a double.

A height value has as label height.

If X has as height Y then Y is a height value.

HIPS VALUE (class)

Description A hips value both has as unit a centimeter unit, and has as datatype a double.

A hips value has as label hips.

If X has as hips Y then Y is a hips value.

INDIVIDUAL ACTIVITY MEASUREMENT (class)

Typology An individual activity measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual activity measurement: "has as tracked activity distance", "has as timezone", "has as steps", "has as sedentary activity duration", "has as sedentary activity distance", "has as moderate activity duration", "has as moderate activity distance", "has as marginal calories", "has as logged activity name", "has as logged activity duration", "has as logged activity distance", "has as light activity duration", "has as light activity distance", "has as intense activity duration", "has as intense activity distance", "has as floors", "has as elevation", "has as distance", "has as calories metabolised", "has as calories b m r" and "has as activity calories".

INDIVIDUAL BLOOD PRESSURE (class)

Typology An individual blood pressure is an individual reading.

INDIVIDUAL BLOOD PRESSURE MEASUREMENT (class)

Description If any of the following relationships hold between X and Y then X is an individual blood pressure measurement: "has as blood pressure systolic" and "has as blood pressure diastolic".

INDIVIDUAL BODY MEASUREMENT (class)

Typology An individual body measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual body measurement: "has as waist", "has as thigh", "has as neck", "has as hips", "has as forearm", "has as chest", "has as calf" and "has as bicep".

INDIVIDUAL FOOD MEASUREMENT (class)

Typology An individual food measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual food measurement: "has as water", "has as sodium", "has as protein", "has as nutritional fat", "has as meal type", "has as food type", "has as food quantity", "has as fibre", "has as carbs" and "has as calories".

INDIVIDUAL GLUCOSE MEASUREMENT (class)

Typology An individual glucose measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual glucose measurement: "has as hba1c", "has as glucose", "has

as drug situation" and "has as dinner situation".

INDIVIDUAL HEIGHT MEASUREMENT (class)

Typology An individual height measurement is an individual reading.

Description If X has as height Y then X is an individual height measurement.

INDIVIDUAL PULSE MEASUREMENT (class)

Typology An individual pulse measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual pulse measurement: "has as pulse", "has as condition" and "has as arrhythmia".

INDIVIDUAL READING (class)

Description If any of the following relationships hold between X and Y then X is an individual reading: "is measured by", "has as note", "has as longitude", "has as latitude" and "has as actuality".

An individual reading both is measured by a manufacturer, and has as date a date.

If any of the following relationships hold between X and Y then Y is an individual reading: "has as longitude" and "has as latitude".

Examples The following are individual readings: individual weight measurements, individual sleep measurements and individual pulse measurements, and so on (9 items in total).

INDIVIDUAL SLEEP MEASUREMENT (class)

Typology An individual sleep measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual sleep measurement: "has as times restless", "has as times rem asleep", "has as times lightly asleep", "has as times deeply asleep", "has as times awake", "has as time to fall asleep", "has as time after wakeup", "has as sleep time", "has as sleep efficiency", "has as restless duration", "has as rem duration", "has as morning time", "has as light sleep duration", "has as deep sleep duration", "has as awake duration" and "has as asleep duration".

An individual sleep measurement has as sleep record at least one sleep record.

INDIVIDUAL WEIGHT MEASUREMENT (class)

Typology An individual weight measurement is an individual reading.

Description If any of the following relationships hold between X and Y then X is an individual weight measurement: "has as weight", "has as water mass", "has as muscle mass", "has as lean mass", "has as fat mass", "has as bone mass", "has as body fat", "has as body dci" and "has as bmi".

INT (class)

Other No information.

INTEGER (class)

Other No information.

IS MEASURED BY (object property)

Description If X is measured by Y then Y is a manufacturer.

If X is measured by Y then X is an individual reading.

KILOGRAM PER SQUARE METER UNIT (class)

Other No information.

KILOGRAM UNIT (class)

Other No information.

KILOMETER UNIT (class)

Other No information.

LATITUDE (class)

Other No information.

LATITUDE VALUE (class)

Description A latitude value has as unit a degrees unit, has as measurement type a latitude, and has as datatype a float.

A latitude value has as label degrees latitude.

LEAN MASS VALUE (class)

Description A lean mass value has as unit a kilogram unit, has as measurement type a calculated whole body lean mass measurement, and has as datatype a double.

A lean mass value has as label lean mass.

If X has as lean mass Y then Y is a lean mass value.

LIGHT SLEEP DURATION VALUE (class)

Typology A light sleep duration value is a duration value.

Description A light sleep duration value has as label light sleep duration.

If X has as light sleep duration Y then Y is a light sleep duration value.

LITER VALUE (class)

Other No information.

LOGGED ACTIVITY (class)

Other No information.

LOGGED ACTIVITY NAME (class)

Description A logged activity name has as unit a dimensionless unit.

LOGGED ACTIVITY NAME VALUE (class)

Description A logged activity name value both has as measurement type a logged activity, and has as datatype a string.

A logged activity name value has as label logged activity name.

If X has as logged activity name Y then Y is a logged activity name value.

LONG (class)

Other No information.

LONGITUDE (class)

Other No information.

LONGITUDE VALUE (class)

Description A longitude value has as unit a degrees unit, has as measurement type a longitude, and has as datatype a float.

A longitude value has as label degrees longitude.

MANUFACTURER (class)

Description A manufacturer both has as manufacturer website a website, and has as manufacturer name a string.

If X is measured by Y then Y is a manufacturer.

MASS PERCENTAGE UNIT (class)

Other No information.

MEAL TYPE (class)

Other No information.

MEAL TYPE VALUE (class)

Description A meal type value has as unit a dimensionless unit, has as measurement type a meal type, and has as datatype a string.

A meal type value has as label meal type.

If X has as meal type Y then Y is a meal type value.

MEASUREMENT TYPE (class)

Other No information.

MEASUREMENT VALUE (class)

Description A measurement value has as unit an unit, has as measurement type a measurement type, and has as datatype a datatype.

MILLIMETER OF MERCURY UNIT (class)

Other No information.

MILLIMOLE PER LITER UNIT (class)

Other No information.

MILLIMOLE PER MOLE UNIT (class)

Other No information.

MORNING TIME VALUE (class)

Description A morning time value has as unit a date unit, has as measurement type a time, and has as datatype a date.

A morning time value has as label morning time.

If X has as morning time Y then Y is a morning time value.

MUSCLE MASS VALUE (class)

Description A muscle mass value both has as unit a kilogram unit, and has as datatype a double.

A muscle mass value has as label muscle mass.

If X has as muscle mass Y then Y is a muscle mass value.

NECK VALUE (class)

Description A neck value has as unit a centimeter unit, has as measurement type a neck value measurement type, and has as datatype a double.

A neck value has as label neck.

If X has as neck Y then Y is a neck value.

NECK VALUE MEASUREMENT TYPE (class)

Other No information.

NUTRITIONAL FAT VALUE (class)

Description A nutritional fat value has as unit a grams value, has as measurement type a fat nutrition value, and has as datatype a double.

A nutritional fat value has as label fat.

If X has as nutritional fat Y then Y is a nutritional fat value.

OCCURRENCE COUNT (class)

Other No information.

PERCENTAGE UNIT (class)

Other No information.

PROTEIN NUTRITION VALUE (class)

Other No information.

PROTEIN VALUE (class)

Description A protein value has as unit a grams value, has as measurement type a protein nutrition value, and has as datatype a double.

A protein value has as label protein.

If X has as protein Y then Y is a protein value.

PULSE VALUE (class)

Description A pulse value both has as unit a count per minute unit, and has as datatype a long.

A pulse value has as label pulse.

If X has as pulse Y then Y is a pulse value.

REM DURATION VALUE (class)

Typology A rem duration value is a duration value.

Description A rem duration value has as label rem duration.

If X has as rem duration Y then Y is a rem duration value.

RESTLESS DURATION VALUE (class)

Typology A restless duration value is a duration value.

Description A restless duration value has as label restless duration.

If X has as restless duration Y then Y is a restless duration value.

SECONDS UNIT (class)

Other No information.

SLEEP EFFICIENCY VALUE (class)

Description A sleep efficiency value has as unit a percentage unit, has as measurement type a device manufacturer calculated sleep efficiency, and has as datatype a double.

A sleep efficiency value has as label sleep efficiency.

If X has as sleep efficiency Y then Y is a sleep efficiency value.

SLEEP RECORD (class)

Other No information.

SLEEP TIME VALUE (class)

Typology A sleep time value is a duration value.

Description A sleep time value has as label sleep time.

If X has as sleep time Y then Y is a sleep time value.

SODIUM NUTRITION VALUE (class)

Other No information.

SODIUM VALUE (class)

Description A sodium value has as unit a grams value, has as measurement type a sodium nutrition value, and has as datatype a double.

A sodium value has as label sodium.

If X has as sodium Y then Y is a sodium value.

STEPS VALUE (class)

Description A steps value has as unit a count unit, has as measurement type a distance moved by unspecified means, and has as datatype an int.

A steps value has as label steps.

If X has as steps Y then Y is a steps value.

STRING (class)

Description If any of the following relationships hold between X and Y then Y is a string: "has as provenance", "has as note" and "has as actuality".

THIGH VALUE (class)

Description A thigh value both has as unit a centimeter unit, and has as datatype a double.

A thigh value has as label thigh.

If X has as thigh Y then Y is a thigh value.

TIME (class)

Other No information.

TIME AFTER WAKEUP VALUE (class)

Typology A time after wakeup value is a duration value.

Description A time after wakeup value has as label time after wakeup.

If X has as time after wakeup Y then Y is a time after wakeup value.

TIME TO FALL ASLEEP VALUE (class)

Typology A time to fall asleep value is a duration value.

Description A time to fall asleep value has as label time to fall asleep.

If X has as time to fall asleep Y then Y is a time to fall asleep value.

TIMES AWAKE VALUE (class)

Description A times awake value has as unit a count unit, has as measurement type an occurrence count, and has as datatype a long.

A times awake value has as label times awake.

If X has as times awake Y then Y is a times awake value.

TIMES DEEPLY ASLEEP VALUE (class)

Description A times deeply asleep value has as unit a count unit, has as measurement type an occurrence count, and has as datatype a long.

A times deeply asleep value has as label times deeply asleep.

If X has as times deeply asleep Y then Y is a times deeply asleep value.

TIMES LIGHTLY ASLEEP VALUE (class)

Description A times lightly asleep value has as unit a count unit, has as measurement type an occurrence count, and has as datatype a long.

A times lightly asleep value has as label times lightly asleep.

If X has as times lightly asleep Y then Y is a times lightly asleep value.

TIMES REM ASLEEP VALUE (class)

Description A times rem asleep value has as unit a count unit, has as measurement type an occurrence count, and has as datatype a long.

A times rem asleep value has as label times rem asleep.

If X has as times rem asleep Y then Y is a times rem asleep value.

TIMES RESTLESS VALUE (class)

Description A times restless value has as unit a count unit, has as measurement type an occurrence count, and has as datatype a long.

A times restless value has as label times restless.

If X has as times restless Y then Y is a times restless value.

TIMEZONE VALUE (class)

Description A timezone value both has as unit a dimensionless unit, and has as datatype a string.

A timezone value has as label timezone.

If X has as timezone Y then Y is a timezone value.

UNIT (class)

Other No information.

USER (class)

Description An user both has as user identifier a string, and has as connection a connection.

WAIST VALUE (class)

Description A waist value both has as unit a centimeter unit, and has as datatype a double.

A waist value has as label waist.

If X has as waist Y then Y is a waist value.

WATER MASS VALUE (class)

Description A water mass value has as unit a kilogram unit, has as measurement type a calculated whole body water measurement, and has as datatype a double.

A water mass value has as label water mass.

If X has as water mass Y then Y is a water mass value.

WATER VALUE (class)

Description A water value both has as unit a liter value, and has as datatype a double.

A water value has as label water.

If X has as water Y then Y is a water value.

WEBSITE (class)

Other No information.

WEIGHT VALUE (class)

Description A weight value both has as unit a kilogram unit, and has as datatype a double.

A weight value has as label weight.

If X has as weight Y then Y is a weight value.

Annex 3
Mappings

1. Risk ontology

@prefix carreSensors: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#> .

@prefix carre: <http://carre.kmi.open.ac.uk/ontology/risk.owl#> .

carre:has_author owl:equivalentProperty dc:Creator

carre:person rdfs:subClassOf foaf:Person

@prefix xsd: <http://www.w3.org/2001/XMLSchema#>

@prefix: owl: <http://www.w3.org/2002/07/owl#>

@prefix: rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

@prefix: xml: <http://www.w3.org/XML/1998/namespace>

@prefix: xsd: <http://www.w3.org/2001/XMLSchema#>

@prefix: rdfs: <http://www.w3.org/2000/01/rdf-schema#>

@prefix dc: <http://purl.org/dc/elements/1.1/>

<http://carre.kmi.open.ac.uk/ontology/mappings>

rdf:type owl:Ontology ;

rdfs:label "Ontology Mappings;

rdfs:comment "This document contains the mappings of the CARRE ontologies' terms to LOD vocabularies for ease of alignment of terms and data from multiple domains.".

carre:risk_element_name rdfs:subClassOf <xsd:string> .

carre:has_author owl:equivalentProperty dc:Creator .

carre:person rdfs:subClassOf foaf:Person .

carre:boolean rdfs:subClassOf <xsd:boolean> .

carre:P00ToP96 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/P00-P96.9> .

carre:A00ToB99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/A00-B99.9> .

carre:Q00ToQ99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/Q00-Q99.9> .

carre:D50ToD89 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/D50-D89.9> .

carre:I00ToI99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/I00-I99.9> .

carre:K00ToK93 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/K00-K93.9> .

carre:H60ToH95 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/H60-H95.9> .

carre:H00ToH59 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/H00-H59.9> .

carre:N00ToN99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/N00-N99.9> .

carre:M00ToM99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/M00-M99.9> .

carre:J00ToJ99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/G00-G99.9> .

carre:L00ToL99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/J00-J99.9> .

carre:L00ToL99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/L00-L99.9> .

carre:E00ToE90 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/E00-E90.9> .

carre:V01ToY98 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/V01-Y98.9> .

carre:Z00ToZ99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/Z00-Z99.9> .

carre:S00ToT98 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/S00-T98.9> .

carre:F00ToF99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/F00-F99.9> .

carre:C00ToD48 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/C00-D48.9> .

carre:O00ToO99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/O00-O99.9> .

carre:R00ToR99 rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10/R00-R99.9> .

carre:icd9code rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD9CM/001-999.99> .

carre:snomedctcode rdfs:subClassOf <http://purl.bioontology.org/ontology/SNOMEDCT/404684003> .

carre:intervention_identifier rdfs:subClassOf <http://purl.bioontology.org/ontology/ICD10PCS/0> .

carre:string rdfs:subClassOf <xsd:string> .

carre:hl7_identifier rdfs:subClassOf <http://purl.bioontology.org/ontology/HL7/C1561446> .

carre:gender_identifier rdfs:subClassOf <http://xmlns.com/foaf/0.1/gender> .

carre:age_identifier rdfs:subClassOf <http://xmlns.com/foaf/0.1/age> .

carre:behavioural_identifier rdfs:subClassOf <xsd:string>@or@a@umlscode .

carre:genetic_identifier rdfs:subClassOf <xsd:string>@or@a@umlscode .

carre:umlscode rdfs:subClassOf <xsd:string> .

carre:educational_material_identifier rdfs:subClassOf <http://purl.bioontology.org/ontology/MEDLINEPLUS/C1456590> .

carre:observable_expression rdfs:subClassOf <xsd:string>.@ .

carre:adjustment_factor rdfs:subClassOf <xsd:string> .

carre:pubmed_identifier rdfs:subClassOf <http://bio2rdf.org/pubmed_vocabulary:PubMedRecord> .

carre:person rdfs:subClassOf <http://xmlns.com/foaf/0.1/Person> .

carre:author rdfs:subClassOf <http://purl.org/dc/elements/1.1/creator> .

2. Sensors ontology

@prefix carreSensors: <http://carre.kmi.open.ac.uk/ontology/sensors.owl#> .
@prefix carre: <http://carre.kmi.open.ac.uk/ontology/risk.owl#> .

@prefix xsd: <http://www.w3.org/2001/XMLSchema#>
@prefix: owl: <http://www.w3.org/2002/07/owl#>
@prefix: rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
@prefix: xml: <http://www.w3.org/XML/1998/namespace>
@prefix: xsd: <http://www.w3.org/2001/XMLSchema#>
@prefix: rdfs: <http://www.w3.org/2000/01/rdf-schema#>

<http://carre.kmi.open.ac.uk/ontology/mappings>

rdf:type owl:Ontology ;

rdfs:label "Ontology Mappings;

rdfs:comment "This document contains the mappings of the CARRE ontologies' terms to LOD vocabularies for ease of alignment of terms and data from multiple domains.".

carreSensors:user rdfs:subClassOf <http://purl.org/cpr/0.9#patient>.

carreSensors:user rdfs:subClassOf <http://xmlns.com/foaf/0.1/Person>.

carreSensors:website rdfs:subClassOf <xsd:anyURI>.

carreSensors:longitude rdfs:subClassOf <http://www.w3.org/2003/01/geo/wgs84_pos#long>.

carreSensors:degrees_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000185>.

carreSensors:latitude rdfs:subClassOf <http://www.w3.org/2003/01/geo/wgs84_pos#lat>.

carreSensors:count_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000189>.

carreSensors:kilometer_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_1000008>.

carreSensors:calories_metabolised_value_measurement_type rdfs:subClassOf <http://purl.bioontology.org/ontology/LNC/LP35952-8>.

carreSensors:calorie_unit rdfs:subClassOf <http://qudt.org/vocab/unit#CalorieNutritional>.

carreSensors:distance_moved_by_unspecified_means rdfs:subClassOf

<http://purl.obolibrary.org/obo/CMO_0000955>.

carreSensors:duration rdfs:subClassOf <http://www.w3.org/2006/time#Interval>.

carreSensors:seconds_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000010>.

carreSensors:timezone_value_measurement_type rdfs:subClassOf <http://www.w3.org/2006/timezone#TimeZone>.

carreSensors:bicep_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000317>.

carreSensors:centimeter_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000015>.

carreSensors:calf_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000186>.

carreSensors:chest_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000316>.

carreSensors:forearm_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000187>.

carreSensors:hips_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000014>.

carreSensors:neck_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000021>.

carreSensors:thigh_value_measurement_type rdfs:subClassOf

<http://purl.obolibrary.org/obo/CMO_0000019>.

carreSensors:waist_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000242>.

carreSensors:calories_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0002208>.

carreSensors:unspecified_nutrition_value rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0002210>.

carreSensors:grams_value rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000021>.

carreSensors:water_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000774>.

carreSensors:liter_value rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000099>.

carreSensors:glucose_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000046>.

carreSensors:hba1c_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000508>.

carreSensors:height_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000106>.

carreSensors:pulse_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000294>.

carreSensors:count_per_minute_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000148>.

carreSensors:percentage_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000187>.

carreSensors:weight_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000012>.

carreSensors:kilogram_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000009>.

carreSensors:bmi_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000105>.

carreSensors:kilogram_per_square_meter_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000086>.

carreSensors:body_fat_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000302>.

carreSensors:mass_percentage_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000163>.

carreSensors:calculated_whole_body_lean_mass_measurement rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0002184>.

carreSensors:muscle_mass_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000448>.

carreSensors:calculated_whole_body_water_measurement rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000000>.

carreSensors:fat_mass_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000305>.

carreSensors:bone_mass_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000461>.

carreSensors:body_dci_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0002253>.

carreSensors:blood_pressure_systolic_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000004>.

carreSensors:millimeters_of_mercury_unit rdfs:subClassOf <http://purl.obolibrary.org/obo/UO_0000272>.

carreSensors:blood_pressure_diastolic_value_measurement_type rdfs:subClassOf <http://purl.obolibrary.org/obo/CMO_0000005>.