New concept proposal

Quantity

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1 Rationale

Quantitative values and units belong together and to every quantity there is a unit. Calculated results in laboratory medicine, such as ratios come without a unit, e.g. the International Normalized Ratio (INR). In such case the UCUM standard annotation offers a unit expression, e.g. {INR} for the International Normalized Ratio or [pH] for pH values.

2 Comparison to other standards/data models

2.1 Oxford Learner's Dictionaries

"[countable, uncountable] an amount or a number of something"

Source: https://www.oxfordlearnersdictionaries.com/definition/english/quantity

2.2 HL7 FHIR

In HL7 FHIR, there is a concept *Quantity* that combines value and unit.

Name	Flags	Card.	Type	Description & Constraints
Quantity	Σ I N		Element	A measured or measurable amount *+ Rule: If a code for the unit is present, the system SHALL also be present* Elements defined in Ancestors: id, extension
value	Σ	0..1	decimal	Numerical value (with implicit precision)
comparator	?! Σ	0..1	code	< | <= | >= | > - how to understand the value QuantityComparator (Required)
unit	Σ	0..1	string	Unit representation
system	Σ I	0..1	uri	System that defines coded unit form
code	Σ	0..1	code	Coded form of the unit

Source: https://www.hl7.org/fhir/datatypes.html

2.3 PhenoPacket Schema

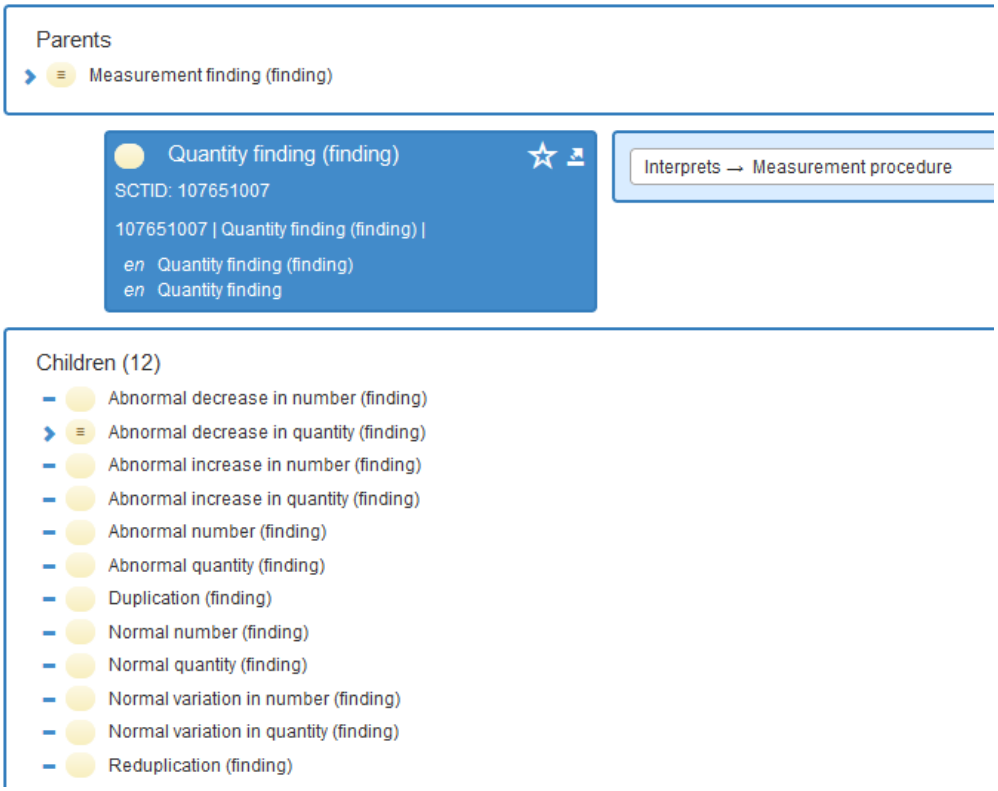
In the PhenoPacket Schema, quantity is defined as a separate entity used for measurement values, see following example

```
value:
    quantity:
        unit:
            id: "UO:0000316"
            label: "cells per microliter"
        value: 24000.0
```

Source: https://phenopacket-schema.readthedocs.io/en/v2/measurement.html#rstmeasurement.

2.4 SNOMED CT

In SNOMED CT, there is a concept 107651007 |Quantity finding (finding)| which is not related to measured amounts but to interpretation of measurement procedures.



And there are concepts related to specific quantities, such as 249131000 |Finding of quantity of liquor (finding)|.

3 Concept information

Concept name	Description	Type	Standard	Value set	Meaning binding SNOMED CT	Meaning binding LOINC
Quantity	an amount or a number of something					
value	countable amount of something, e.g. 300	quantitative				
unit	unit of the amount, e.g. mL, mg, min	Unit				
comparator	qualifier describing whether the value is the precise one or not, e.g. a laboratory measurement result below detection limit	qualitative		<; <=; >; >=		

4 Impact on the SPHN Dataset

The new concept would have an impact on all existing concepts in the SPHN Dataset holding numeric values:

- Heart Rate (replace type Frequency with Quantity for rate)
- Systemic Arterial Blood Pressure (replace type quantitative with Quantity for all three pressure composedOfs; remove unit)
- Body Temperature (replace type quantitative with Quantity for temperature; remove unit)
- Respiratory Rate (replace type Frequency with Quantity for rate)
- Oxygen Saturation (replace type quantitative with Quantity for saturation; remove unit)
- Body Height (replace type quantitative with Quantity for height; remove unit)
- Body Weight (replace type quantitative with Quantity for weight; remove unit)
- Lab Result (see separate documentation with additional changes to Lab Result)
- Drug Administration Event (remove Substance Amount, see separate documentation with additional changes to Drug Administration Event)
- Drug Prescription (remove Substance Amount, see separate documentation with additional changes to Drug Prescription Event)
- Allergy Episode (replace type Duration with Quantity for manifestation duration; replace type Duration with Quantity for exposure duration)
- Radiotherapy Procedure (replace quantitative with Quantity for radiation amount; remove unit)
- Circumference Measure (replace quantitative with Quantity for circumference; remove unit)
- Gestational Age at Birth (replace quantitative with Quantity for value; remove unit)

- Tumor Specimen (replace quantitative with Quantity for tumor purity; remove unit)
- Diagnostic Radiologic Examination (replace quantitative with Quantity for radiation amount; remove unit)
- Central Venous Pressure (replace quantitative with Quantity for value; remove unit)
- Inhaled Oxygen Concentration (replace quantitative with Quantity for value; remove unit)

5 Discussion

The new *Quantity* concept allows numerical data to be stored in a better structured way in the future, especially when numerical values cannot be expressed in absolute numbers but as an approximation, e.g. >30. The *Quantity* concept has a high degree of reuse; it can be used in 18 already existing concepts in the SPHN Dataset. The concept adheres to the SPHN guiding principles for concept design and reflects design patterns in other standards/data models.

6 Example

Examples where *Quantity* (including value, unit, comparator) can be used, or could be used in the future:

Laboratory normal ranges: total bilirubin <1.00 mg/dL
Value: 1.00
Unit: mg/dL
Comparator: <

Laboratory measurement result below limit of detection or limit of quantification: TSH <0.02 mU/L
Value: 0.02
Unit: mU/L
Comparator: <

Age as an inclusion criteria for a research project: patients with age >= 21 years AND <= 60 years
Value: 21
Unit: a
Comparator: >=

Value: 60
Unit: a
Comparator: <=

Obfuscation or de-identification of values: > 85 years
Value: 85
Unit: a
Comparator: >

Patient with a low oxygen saturation: <90%
Value: 90
Unit:%
Comparator:<