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A Categorial Structure for Identifying Physiological Measurement Observables

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Abstract. Patient measurements to characterize pathophysiological phenomena are often difficult to describe. A controlled terminology for this domain is needed, to describe methods, appropriate reference values and to report results. This is a proposal for a categorial structure for such a terminology

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1. Introduction

Functional measurements are important in management of many important diseases, and are often based on imaging and signal processing with secondary measurements and levels of postprocessing, resulting in complex nomenclature with risk of confusion. An example is LAVI(2dMOD), i.e. "left atrial volume estimated by a 2-dimensional method of disks model, indexed by body surface area". There is a need for more systematic nomenclature of this domain. Some of this has been attempted in Clinical LOINC [1]. However, the structure of LOINC is adapted for clinical laboratory science and not optimal for functional patient measurements.

This paper outlines a proposed structure to adapt terminological systems better to identify physiological measurements, to facilitate unambiguous description of methods, diagnostic reporting and selection of reference values for interpretation of measurements.

2. Dedicated Kinds of Property

In laboratory medicine useful nomenclature is based on standardized description, based on controlled combinations of selected concepts (language independent) from prescribed categories, a so called **categorial structure**, as described in European standard EN 1614 [2]. Laboratory measurements are described as a **kind of property** of a **component** in a **system**, determined by a **method**. To describe physiologic measurements, however, a slightly more complex model is needed.

The essence of the proposed model is a small set of well understood entities, each with a small number of relevant measurable kinds of properties. Combining this with methods for measurement and challenges (condition during measurement), temporal relations and postprocessing operations (e.g. correction for body size) gives an economic

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way to represent very complex observables. The classes comprising the model are here listed with some examples, but need to be further elaborated and defined, possibly in international standardization.

The proposed model is centered on a few types of structural/functional **entity**, each with a set of potential **functions** or **properties**. Some important examples are given in table 1.

Entity type	Kinds of properties (examples)	Comments, examples
Wall	thickness, motility, strain, strain rate, echogenicity, radiolucency and its heterogeneity, continuity	Muscular wall of heart, urinary bladder
Lumen (inside a hollow structure)	diameter, area (in a sectional plane), volume, stroke volume, volume fraction, fractional shortening, presence of pathological structure, presence of flow	Heart ventricle, inside of artery, airways
Tubular structure	diameter, area (cross section), plaque (presence, size, echolucency, heterogenity, shape), patency, tortuosity	Blood vessel, ureter,
Valve	thickness, mobility, patency, regurgitation, prosthesis	Heart valves, venous valves
Solid structure	presence, size, diameter, volume, echogenicity, radiolucency, uptake of tracer/contrast, rhythmicity (e.g. heart rate), mobility	Kidney, thrombus,
Patient	height, weight, body surface area, exercise capacity	Properties applicable to patient as a whole
Flow	presence (patency), direction, velocity, averaged velocity integral, volume flow, pulsatility, wave reflection, acceleration, deceleration	Arterial, venous, respiratory, flow across heart valve

Table 1. Entities with corresponding functional properties

Several other dimensions are useful for a systematic description:

Method used for measurement/data collection is of obvious importance, and includes technical equipment used, such as ultrasound, magnetic resonance, scintigraphy, and sometimes also **view/orientation** (such as parasternal view of heart, anteroposterior view of pelvis).

Timing Many properties have a relation to a time axis, e.g. velocity, acceleration, or relation to events such as heart beat (systole, diastole).

Challenge – some observables can only be described by their relation to a challenge, such as body position, muscular contraction, breathing, external compression, pharmaceutical challenge.

Post processing – frequently observables are adjusted by calculation of indexes, dividing by body mass, or other measurements, and sometimes advanced processing by imaging algorithms, and this often is an important part of the description.

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