## Common HRV Time-Domain Measures

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDNN</td>
<td>ms</td>
<td>Standard deviation of NN intervals</td>
</tr>
<tr>
<td>SDRR</td>
<td>ms</td>
<td>Standard deviation of RR intervals</td>
</tr>
<tr>
<td>SDANN</td>
<td>ms</td>
<td>Standard deviation of the average NN intervals for each 5 min segment of a 24 h HRV recording</td>
</tr>
<tr>
<td>SDNN index (SDNNI)</td>
<td>ms</td>
<td>Mean of the standard deviations of all the NN intervals for each 5 min segment of a 24 h HRV recording</td>
</tr>
<tr>
<td>pNN50</td>
<td>%</td>
<td>Percentage of successive RR intervals that differ by more than 50 ms</td>
</tr>
<tr>
<td>HR Max – HR Min</td>
<td>bpm</td>
<td>Average difference between the highest and lowest heart rates during each respiratory cycle</td>
</tr>
<tr>
<td>RMSSD</td>
<td>ms</td>
<td>Root mean square of successive RR interval differences</td>
</tr>
<tr>
<td>HRV triangular index</td>
<td>ms</td>
<td>Integral of the density of the RR interval histogram divided by its height</td>
</tr>
<tr>
<td>TINN</td>
<td>ms</td>
<td>Baseline width of the RR interval histogram</td>
</tr>
</tbody>
</table>

Interbeat interval, time interval between successive heartbeats; NN intervals, interbeat intervals from which artifacts have been removed; RR intervals, interbeat intervals between all successive heartbeats.
Cardiac Systolic Event

Dependencies -> Extensibility

Electrical
- AE: Yes
- VE: Yes

Mechanical
- AE: Maybe
- VE: Yes

Pulsatile
- AE: No
- VE: Yes

ECG signals, electrograms

heart sounds, +/- seismic

PPG (contact, noncontact)

Atrial event (AE) detection
Ventricular event (VE) detection

PRSteiner - Dartmouth
IEEE 1752 Standard for Mobile Health Data

Expansion of Mobile Health Data overlapping into the Digital Biomarker Space...

Wearables & ext. detectors

Internal/implant sensors*

Apps

Phasor, EHR, AI & DL

Wearables

Implantables

Apps
Atomicity
- Determine desired granularity of schema’s data representations

Balancing parsimony and complexity
- Pragmatics and the 80/20 rule
- Example: OmH explicitly determined relationship of physical activity to glucose to be outside 80/20 region...

Balancing permissiveness and constraints
- Pragmatics for value sets units, cardinality

Designing for data liquidity
- Data interchange: Data’s meaning same for sender and receiver
  - Header schema: Operational context for metadata - data payload
    : Data point creation and identification
    : Acquisition provenance (informed by M2DK mPROV ?)
  - Measurement schema: Clinical context for metadata

Alignment with clinical data standards
- Semantic interoperability by relying on existing vocabularies (ex. SNOMED, LOINC, etc) and units of measure (UCUM Codes)

Modeling of time

https://www.openmhealth.org/documentation/#/schema-docs/schema-design-principles
Data Point:

• A discrete measurement (or observation) on a single unit of observation
• Discrete: “distinct in time of acquisition, location, or origin/source”
• May be multidimensional +/- directionality

Data Point Series:

• An ordered sequence of data points that share the same metadata

Content:

• An instantiation of a single unit of observation
IEEE 1752.1
Standard for Mobile Health Data

IEEE 1752.2
Standard for Mobile Health Data

- Metabolic
- Cardiorespiratory

https://opensource.ieee.org/omh/1752
IEEE 1752.1
Standard for Mobile Health Data

• Metabolic
• Cardiorespiratory

IEEE 1752.2
Standard for Mobile Health Data

- Metabolic
- Cardiorespiratory

- Pulse & Rhythm
- Blood Pressure & Hemodynamics
- Respiratory & Gas Exchange
Assessing Secondary Dependencies

- **Autonomic Tone & Modulation**
- **Maladaption & Pathophysiology**
- **Physical Activity & Mobility**
- **Externalities**
  - Altitude
  - Temperature
  - Humidity
  - other relevant schemas

**CONTEXTUALITY**