V3_DCModels_R1_I1_2010Sep- org.hl7.HeartRate-v0.74

Detailed Clinical Models 3Version 7HL (DCM)

Release 1

(Universal Realm)

1st Informative Ballot

DCM example org.hl7.HeartRate-v0.74

September 2010 / Version after ballot reconciliation September 2013

Updated for implementation May 2014 v 0.74

Co-Chair/Co-Editor	William Goossen Results 4 Care B.V. wgoossen@results4care.nl
Co-Chair	Ian Townend NHS ian.townend@nhs.net
Co-Chair	Stephen Chu NEHTA stephen.chu@nehta.gov.au
Co-Chair	Klaus D Veil HL7 Systems and Services Klaus@Veil.net.au
Primary Editor:	Anneke Goossen Results 4 Care B.V. agoossen@results4care.nl
Co-Editor:	Jos Baptist Nictiz Baptist@nictiz.nl
Co-Editor:	Ewout Kramer Parelsnoer Initiative e.kramer@furore.com
Co-Editor:	Abel Enthoven Furore B.V. a.enthoven@furore.com
Co-Editor:	Michael van der Zel University Medical Center Groningen m.van.der.zel@ict.umcg.nl and Results 4 Care B.V. mvdzel@results4care.eu
Co-Editor:	Ybranda Koster-de Jong At time of development at Results 4 Care B.V. info@results4care.nl
Technical Editor	William Goossen
Project Working Group also includes:	Nictiz, Parelsnoer initiative, OIZ

Table of Contents

org.hl7.HeartRate-v0.74

DCM::CoderList	Anneke Goossen, Michael van der Zel, Abel Enthoven
DCM::ContactInformation.Name	Results4Care
DCM::ContactInformation.Telecom	info@Results4care.nl
DCM::ContentAuthorList	Anneke Goossen, Ybranda Koster
DCM::CreationDate	5-11-2009
DCM::DescriptionLanguage	nl, en
DCM::Id	DCMR4C00009
DCM::KeywordList	Heart Rate, Pulse Rate D006339
DCM::LifecycleStatus	Draft
DCM::ModelerList	Michael van der Zel, Ybranda Koster, William Goossen
DCM::Name	org.hl7.HeartRate
DCM::PublicationDate	2014-May-24
DCM::PublicationStatus	Published
DCM::ReviewerList	
DCM::Version	0.74

Revision History

Version 0.1 till version 0.64 is development, review and adjustments of the DCM. Version 0.64 is developed in Enterprise Architect.
Version 0.64 till version 0.66 are adjusted in cooperation with the project Parelsnoer Initiative. The scope was the development of the information model.
Version 0.65 is the English translation of version 0.64.
Version 0.66 is the adjustment to the new template for a DCM and the preparation for the HL7 ballot in 2010.
0.70 is information model style corrected. Versions 0.71 and 0.72 deal with partial ballot reconciliation from HL7 community.
Version 0.73: all HL7 comments have been reconciled in the text and model and verified one by one. E.g. added duration of measure and others.
Added missing codes for codes for 1 minute min, max, mean.
Version 0.74. Added missing code for palpation.

Heart Rate

This DCM concerns the observation pulse rate. The pulse rate is the pumping motion of the heart. In this DCM all concepts that belong to the manual measurement of the pulse rate are addressed.

Purpose

Purpose is to measure the pulse rate to check the blood flow of the patient. During this measuring the frequency, strength, equality, regularity and volume of the heart is checked. In a lot of patients the measuring of the pulse rate is important. In patients with a defect of the blood flow, by whom the blood flow might change, the pulse rate should be measured more than twice a day (Arets, Vaessen & Gijselaers, 1988). These are all patients with a heart or cardiovascular condition due to various causes, such as bleeding, medications, or alterations in nervous system function (Arets, Vaessen & Gijselaers, 1988).

Evidence Base

In counting the heartbeats the speed, frequency per minute, in which the heart pumps the blood through the body is observed. During one heart beat the heart muscle first contracts the atriums and than the ventricles. The pulse is measured by putting pressure on any artery in which pulsations can be felt (Usually the radial artery pulse). In addition to this list, the pulse can be felt directly from the precordium in the chest. The frequency per minute is the pulse rate. This is usually equal to the heart rate. Therefore both terms are used. (medicine online, 2008)
Arteries the pulse rate can be observed are (TPVO, 2002):
1. Superficial temporal artery (temple)
2. Carotid artery (neck): in circulation problems this site is most often used, because the artery is easy perceptible and accessible;
3. Brachial artery (upper arm);
4. Radial artery (pulse);
5. Femoral artery (groin);
6. Popliteal artery (popliteal);
7. Artery Dorsalis pedis (top of the foot);
8. Posterior Tibial artery (ankle);
9 Tibial artery (lower leg);
10. Subclavian artery (clavicle);
11. Fontanel (on baby's);
12. External carotid artery (jaw)

Beside the beats per minute, the frequency, there are more aspects to the pulse rate than can be observed: regularity, volume, equality, strength (TPVO, 2002; http://mens-en-gezondheid.infonu.nl).

The **regularity** is the rhythm. This can be regular or irregular. This means that the pause between the beats, are just as long or are different in length.The irregular rhythm has several forms:

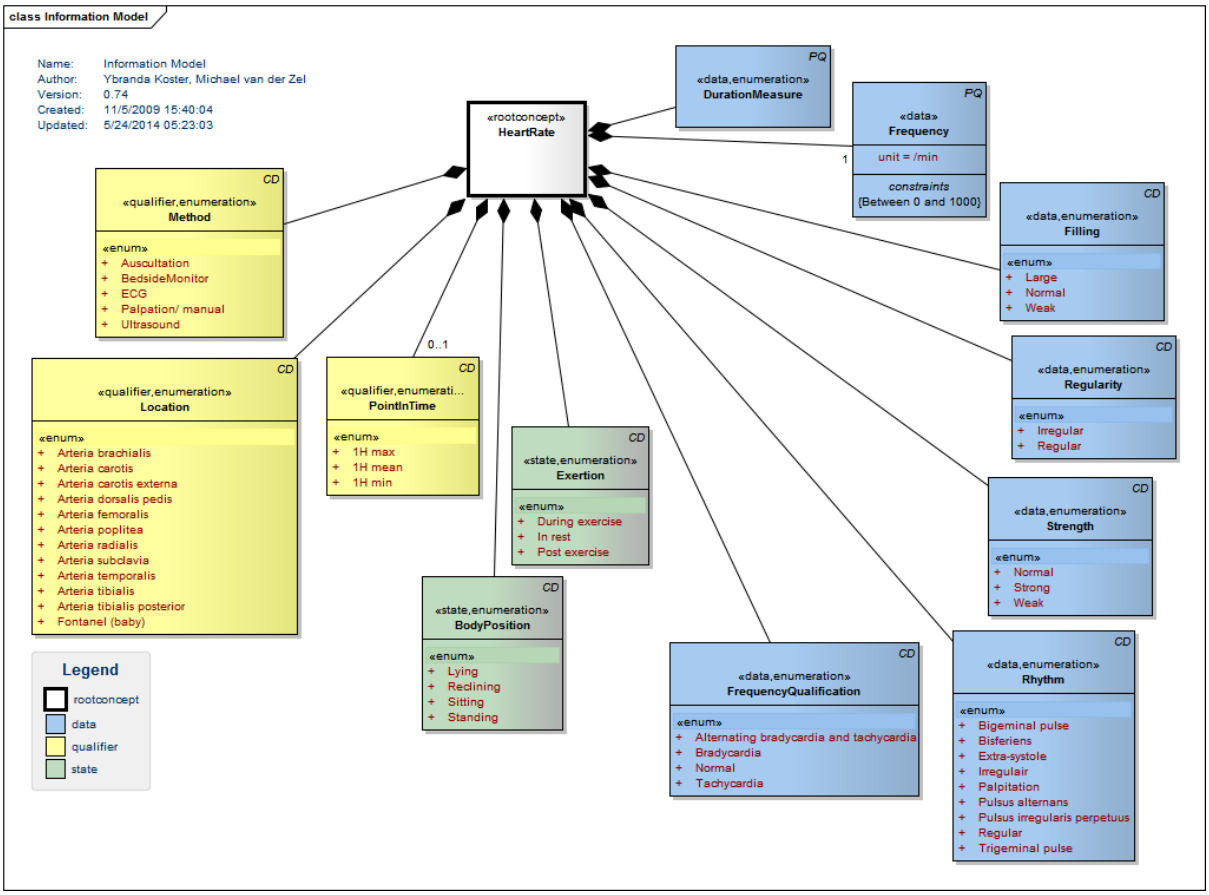
- Premature atrial contraction (Extra-systoles): A weak beat is followed by a strong beat.
- Palpitations: Patient is aware of the beating of his or her own heart.
- Bigeminal pulse: Two heart beats in quick succession, each pair is separated by a longer interval
- Trigeminal pulse: A pause after every third heart beat.
- Pulsus alternans: Strong and weak beats alternate
- Pulsus irregularis perpetuus: The pulse is completely irregular and unequal.
- Pulsus Bisferiens: A pulse with two systolic peaks.

The **filling** is the (estimated) amount of blood that is forced through the arteries with each contraction. The **equality** how equal the amount of blood forced through the arteries is each contraction. The **strength** is the pressure with which the heart muscle pumps the blood through the heart into the aorta.

Information Model

HeartRate **is** rootconcept
HeartRate **has** Method
HeartRate **has** Exertion
HeartRate **has** BodyPosition
HeartRate **has** Regularity
HeartRate **has** FrequencyQualification
HeartRate **has** Volume
HeartRate **has** Location
HeartRate **has** Strength
HeartRate **has** Rhythm

HeartRate **has** Frequency
Location **is a** *coded description*
FrequencyQualification **is a** *coded description*
BodyPosition **has** Position
Exertion **is a** *coded description*
PositionMeasure **is a** Position
Frequency **is a** *physical quantity*
Volume **is a** *coded description*
Regularity **is a** *coded description*
Strength **is a** *coded description*
Rhythm **is a** *coded description*
Method **is a** *coded description*



Concept	Definition
HeartRate SCT:364075005 heart rate	This is about the observation and documentation of the heart rate of a person.

Concept	Definition
BodyPosition SCT:9851009 body position	The body position of the patient during the measure of the heart rate.

finding, SCT:397155001 body position	**Lying** SCT: 102538003 recumbent body position **Reclining** SCT: 272587006 position with tilt **Sitting** SCT: 33586001 sitting position **Standing** SCT: 10904000 orthostatic body position

Concept	Definition
DurationMeasure LOINC:code 8888-0 displayName Heart rate measure duration	Time used for this measure (e.g. 15 seconds, 1 minute).

Concept	Definition
Exertion SCT:19487008 Exertion	After exercise the pulse rate is increased **During exercise** SCT: 128976003 exercise state **In rest** SCT: 128975004 resting state **Post exercise** SCT: 128978002 post exercise state

Concept	Definition	
Filling SCT:366201008 pulse volume - finding	Interpretation of the filling of the vessels during heartbeat.	
	Large SCT: 271640005 large volume pulse	The volume is large
	Normal SCT: 421014001 full pulse volume	The volume of the pulse is normal
	Weak SCT: 64661000 weak pulse	The volume is weak

Concept	Definition	
Frequency SCT:364075005 heart rate, LOINC:code 8867-4 displayName heart rate	The mechanics of the heart rate: number of beats per minute	
Constraint	Between 0 and 1000	inv:self.value>=0 and self.value<1000

Concept	Definition	
FrequencyQualification SCT:301113001 Finding of heart rate	Interpretation of the rate of the heart as beats per minute	
	Alternating bradycardia and tachycardia SCT: 74615001 tachycardia-bradycardia	Alternating bradycardia and tachycardia: heart beats alternately more than 100 beats per minute and less than 60 beats per minute.
	Bradycardia SCT: 48867003 bradycardia	Heart beats less than 60 beats per minute in rest
	Normal SCT: 76863003 normal heart rate	The frequency of the heart rate is normal.
	Tachycardia SCT: 3424008 tachycardia	Heart beats more than 100 beats per minute.

Concept	Definition
PointInTime SnomedCT:code: 272105005 displayName: points in time	**1H max** LOINC: code 8869-0 displayName Heart rate 1 hour maximum
	1H mean LOINC:code 41920-0 displayName Heart rate 1 hour mean
	1H min LOINC: code 8879-9 displayName Heart rate 1 hour minimum

Concept	Definition
Regularity SCT: 364074009 Regularity of heart rhytm	Interpretation of the regularity of the heart rate.
	Irregular SCT:61086009 pulse irregular
	Regular SCT: 271636001 pulse regular

Concept	Definition
Location SCT: 363704007 procedure site	The location where the heart rate is measured. **Arteria brachialis** SCT: 17137000 brachial artery **Arteria carotis** SCT: 69105007 carotid artery **Arteria carotis externa** SCT: 22286001 external carotid artery **Arteria dorsalis pedis** SCT: 86547008 dorsalis pedis artery **Arteria femoralis** SCT: 181349008 superficial femoral artery **Arteria poplitea** SCT: 43899006 popliteal artery **Arteria radialis** SCT: 45631007 radial artery **Arteria subclavia** SCT: 36765005 subclavian artery **Arteria temporalis** SCT: 15672000 superficial temporal artery **Arteria tibialis** SCT: 181351007 tibial artery **Arteria tibialis posterior** SCT: 181358001 posterior tibial artery **Fontanel (baby)** SCT: 272681004 fontanelle

Concept	Definition	
Method SCT:84203001 has method	The way how the heart rate is measured and observed.	
	Auscultation SCT: 37931006 auscultation	The heart rate is determined by auscultation.
	BedsideMonitor SCT: 88140007 cardiac monitor surveillance	The heart rate is determined by continious monitoring.
	ECG SCT: 46825001 ecg monitoring	The heart rate is determined by an electrocardiographic monitoring
	Palpation/ manual SCT: 113011001 Palpation	The heart rate is determined by palpation on a peripheral artery.
	Ultrasound SnomedCT:16310003 Ultrasound(procedure)	

Concept	Definition	
Strength Parelsnoer: 3.4	The power with which the blood is pumped through the heart and arteries. This is subtle different from the filling. It is not the peak volume, but the volume increase / decrease per time unit.	
	Normal Parelsnoer: 3.1	The strength is normal
	Strong Parelsnoer: 3.2	The strength is strong
	Weak Parelsnoer: 3.3	The strength is weak

Concept	Definition
Durationofmeasure LOINC:code 8888-0 displayName Heart rate measure duration	Describes how long the heart rate was measured, e.g. 15 seconds, one minute

Concept	Definition	
Rhythm SCT:301149000 Pulse rhythm	Interpretation of the rhythm of the heart rate.	
	Bigeminal pulse SCT: 195103000 bigeminal pulse	Double beats with intervening gap
	Bisferiens SCT: 415216000 pulses bisferiens	Pulse with two systolic peaks
	Extra-systole SCT: 284470004 premature atrial contraction	A weak beat is followed by a strong beat
	Irregulair SCT: 248650006 heart irregular	Irregular heart rate
	Palpitation SCT: 80313002 palpitations	Being aware of the beating of one's own heart
	Pulsus alternans SCT: 42807005 pulsus alternans	Strong and weak beats alternate
	Pulsus irregularis perpetuus SCT: 271638000 pulse regularly irregular	Pulse is completely irregular and unequal
	Regular SCT: 248649006 heart regular	Regular heart beat
	Trigeminal pulse SCT: 29036000 trigeminal pulse	Triple beats with intervening gap .

Example Instances

Not available

Instructions

For the manual measurement of the pulse rate a watch with a second hand or a pulse counter. The pulse rate is measured at the pulse, in case the pulse is not very perceptible, the neck artery, temporal artery or the groin artery are also often used (Schnell, 1990). Put the index-, middle-, and ring finger length wise on the artery in order to measure the pulse rate. When measuring with the thumb it is possible to feel the own pulse rate (Vlaamse kruis, 2008).

The pulse is barely perceptible in case of severely disturbed circulation, such as a massive bleeding. The measurement preferably takes place when the patient is at rest and is relaxed and sitting down. The pulse rate can be measured for 15 or 30 seconds and than respectively be multiplied by 4 or 2 to get the pulse rate per minute. The outcome has to be corrected for the inaccuracy of the measurement. In a measurement of 15 seconds the pulse rate is calculated by: (amount of beats in 15 seconds) * 4 ± 4. In a measurement of 30 seconds the pulse rate in calculated by: (amount of beats in 30 seconds) * 2 ± 2. This means that the calculated pulse rate is a margin where the actual pulse rate is. For example, when 15 beats are measured in 15 seconds, the pulse rate is 15 * 4 ± 4 = 60 ± 4. The pulse rate

per minute in this case is between 56 and 64.
Usually the pulse rate is measured for 15 seconds, but in case of a irregular pulse rate, the pulse is measured for 30 seconds. (Arets, Vaessen & Gijselaers, 1988).
After the measurement is done the pulse rate is documented on the list of physical data. The other aspects of the pulse rate, such as regularity, strength, are documented in the patients health record. Also improvements are documented.

The heart rate can also be determined by auscultation, continues monitoring and ECG.

Interpretation

The average pulse rate in rest is:

- 100-160 beats per minute in baby's younger than 1 year old
- 70-120 beats per minute in children between 1 and 10 years old
- 60-100 beats per minute in people more than 10 years old. The average pulse rate in a male is between 70 and 85 beats per minute and in a female the pulse rate is between 75 and 90 beats per minute.
- 40-60 beats per minute in trained athletes

When the pulse rate in an adult is more than 100 beats per minute we speak of tachycardia. In a pulse rate less than 60 beats per minute we speak of a bradycardia. A patient can also have an alternating heartbeat with slow and then fast pulse rate. This interpretation is the frequency qualification of the heart beat.
The interpretation of the deviation of the pulse rate is, for a physician, reason to make an ECG. The interpretation of an ECG is restricted to physicians or specialised nurses.

Care Process

The pulse rate provides information about the functioning of the heart. Together with other data, such as body temperature, respiration and blood pressure, the pulse rate provides important indications to the health condition of a person. These observations are put into a curve in the hospitals so the progress can be followed in time.
The observation of the pulse rate is often done. Usually as a part of the physical examination. This is done to monitor the progression of the disease. Just like in other observations the outcome of the pulse rate can be of influence on the treatment (Schnell, 1990).
The pulse rate can also be measured using a ECG or a Doppler test. These methods of observation however, are beyond the scope of this DCM.

Example of the Instrument

None available

Constraints

None known

Issues

- The DCM Body Position needs to be developed
- Need SCT for PointInTime, Method.Ultrasound?

References

Projects/ Projecten:

eDiabetes, Nictiz, Parelsnoer Initiative

Literature/ Literatuur:
Archetype openEHR-EHR-OBSERVATION.Heart_rate_pulse.v1.html. Verkregen op 23 juni 2010, van http://www.openehr.org/knowledge/

Zorginformatiemodel Doc_Obs_Hartslag_V1.1.doc. Verkregen op 2 oktober 2008, van http://www.zorginformatiemodel.nl

De Hartslag. Verkregen op 2 oktober 2008, van http://www.hetvlaamsekruis.be/ehbo_info/cursus/09_Algemene_onderdelen/DeHartslag.htm

Hartfilmpje of electrocardiogram (ECG). Verkregen op 2 oktober 2008, van http://www.hartstichting.nl/go/default.asp?mID=5545&rID=1877

Schnell, H., (1990). *Handleiding verpleegkundige vaardigheidstraining. Diagnose. Het observeren en beoordelen van de pols.* Lochem, De Tijdstroom.
Arets, J. R. M., Vaessen, J. P. & Gijselaers, H., (1988). *Met zorg verplegen*. Deel 1b. Spruyt, Van Mantgem & De Does: Leiden.

Hamilton, H.K., Rose, M.B., (1993) *Verpleegkundige handelingen en procedures, De praktijk van het verplegen.* Lemma BV: Utrecht.

Custers, A., Nas, H., Transferpunt Vaardigheidsonderwijs (TPVO), (2002). *Docentenhandleiding Kwalificatieniveau 4. Observatietechnieken.* Houten/ Mechelen, Bohn Stafleu Van Loghum.

MacCloskey Dochterman, J. C., Bulechek, G.M., (2000). *Verpleegkundige interventies*. St Louis, Missouri, Mosby inc.

De pols. Verkregen op 2 oktober 2008, van http://mens-en-gezondheid.infonu.nl

Heart rate- Pulse rate. Verkregen op 11 december 2008, van http://www.medicineonline.com/topics/H/2/Heart-Rate/Pulse-Rate.html

Vocabulary/ Vocabulair:
Name code system/ Naam code systeem: Snomed CT (SCT)

OID code system/ OID code systeem : 2.16.840.1.113883.6.96

Functional Model

Not defined

Traceability to other Standards

Not defined

Disclaimer

Nictiz as ordering customer and Results 4 Care B.V. and Parelsnoer as subcontractor give utmost care to the reliability and timeliness of data in this DCM, Detailed Clinical Model. Errors and inaccuracies may occur. Nictiz, Results 4 Care and Parelsnoer are not responsible for damages resulting from errors or inaccuracies in the information, nor for damages arising from problems caused by, or inherent in the spreading of information via the Internet, as failures or interruptions from either errors or delays in the distribution of

information or services by Nictiz, Results 4 Care or Parelsnoer, or form you to Nictiz, Results 4 Care or Paerlsnoer by means of a website from Nictiz, Results 4 Care or Parelsnoer of by e-mail, or otherwise electronically.
Nictiz , Results 4 care and Parelsnoer do not accept responsibility for possible damage suffered as a result of the use of data, advise or ideas provided by or in name of Nictiz, Results 4 Care or Parelsnoer by way of this DCM. Nictiz does not accept responsibility for the content of information in this DCM to which or from which using a hyperlink or otherwise, is referred.

In case of contradictions in the mentioned DCM documents en files the priority of the relevant documents is stated by the most recent and highest version mentioned in the revision (version management).
In case information that is included in the electronic version of this DCM is also provided in writing, in case of textual differences the written version will determine. This applies if the version description and date of both are equal. The definitive version has priority over a concept version. A revised version has priority over a previous version.

Terms of Use

The DCM is open source, so free to use, not to be changed.
Changes in the content en codes are seen upon as a infringement of copyright and is damaging for the goal of use: realisation of semantic interoperability.
You can suggest changes at info@results4care.nl
Revision suggestions will be looked at and may lead to:

a. revised DCM and results if accepted
b. variations of the DCM adapted on a local situation.

This is all based upon : a “common ownership” but not a “special stewardship”.

Copyrights

none applicable