



Detailed Clinical Model Blood Pressure

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nl.NI2012(NictizPSISHBOLVG).BloodPressure-v1.04

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1.1 Revision History

nl.Nictiz.Bloodpressure-v0.99: This DCM was used for the DCM about blood pressure developed for Stichting Health Base (SHB). The versioning for that DCM is:

Versie 0.1: first draft based on nl.Nictiz.Bloeddruk-v0.99. DCM without invasive blood pressure.

Versie 0.2: review of the information model by Michael van der Zel, Results 4 Care.

Versie 0.3: invasive blood pressure integrated in the DCM. Changed name of the DCM

Versie 0.4: changes in information model.

Versie 0.5: instructions in some parts of the DCM deleted. REadu for review by clinician.

Versie 0.6: additions in information model with elements important for for a General practionar.

Versie 0.7: review by Stichting Health Base.

Versies 0.8 en 0.9: changes in DCM and information model based on the review comments of SHB.

Versie 1.0: final version for SHB.

Version: nl.NI2012(NictizSHB).BloodPressure-v0.103 is an adjusted version based on

nl.Nictiz.Bloodpressure-v0.102 en nl.HealthBase.Bloeddruk-v1.0

Version: «DCM» nl.NI2012(NictizPSISHBOLVG).BloodPressure-v1.04

full English translation, based on SHB changes.

1.2 Concept

Blood pressure is the pressure with which the blood presses against the walls of the arteries (<http://www.gezondheidsplein.nl>, 2008), or the hydrostatic pressure the blood has on the circulating blood on the walls of blood vessels (<http://nl.wiktionary.org/wiki/bloeddruk#Nederlands>, 2008).

Blood pressure is expressed by means of two numbers, the systolic and diastolic blood pressure (Custers e.a, 2002).

1.3 Mindmap

None available for this DCM

1.4 Purpose

Purpose is to determine the blood pressure of a person (adult, child).

Reason: the blood pressure is a parameter to determine the situation of the circulation and is expressed as systolic and diastolic pressure in mm Hg (Codex Medicus, 2010).

1.5 Patient Population

The blood pressure can be measured in many different patient categories throughout healthcare.

1.6 Evidence Base

What is blood pressure?

Blood pressure is the pressure with which the blood presses against the walls of the arteries (<http://www.gezondheidsplein.nl>, 2008), or the hydrostatic pressure the blood has on the circulating blood on the walls of blood vessels (<http://nl.wiktionary.org/wiki/bloeddruk#Nederlands>, 2008).

Blood pressure is documented by means of two prefixed numbers, the systolic and diastolic blood pressure (Custers e.a, 2002). The systolic pressure or Peak pressure is the maximum pressure that is build in the aorta or the main body artery when the left ventricle contracts. The diastolic pressure or lowest pressure is the minimum pressure that occurs between two contractions of the heart, when the heart fills with blood again. Together these two values give a insight in the average arterial pressure (<http://nl.wikipedia.org/wiki/Bloeddruk>, 2008).

According to Sesink and Kersten (1997) the blood pressure is influenced by:

- Age: when people get older the blood pressure rises;
- Lifestyle: for example body exercise, smoking or non-smoking, nutritional habits, social contacts;
- Inheritance: there is a inheritable component in getting a raised blood pressure;
- Inner and outer influences: for example be frightened, sudden trauma's that cause a severe bleeding.

Eijken (1999) adds the gender and the condition of the heart and blood vessels to this list.

The measuring of the blood pressure

There are two distinct methods to measure blood pressure (Langewouters et.al., 1995):

- Direct or invasive; this method gives insight in the actual blood pressure, including the blood pressure variability and is measured by means of a catheter in the artery, for example the radial artery.
- Indirect or non-invasive: this method gives insight in the blood pressure at that moment. Methods are:

- a) The auscultatory method (Riva-Rocci-Korotkoff, RRK),
- b) The oscillometric method (Marey),
- c) The Peñáz/Wesseling-method (FinapresTM en Portapres).

The methods a and b determine the blood pressure at that moment, c besides the height of the blood pressure also gives a pattern of the blood pressure wave.

The mostly used method is the indirect or non-invasive method. The direct or invasive method is limited because of the risks involved due to the invasive character of this method. There for this method is used in severely ill patients. (Langewouters, 1995).

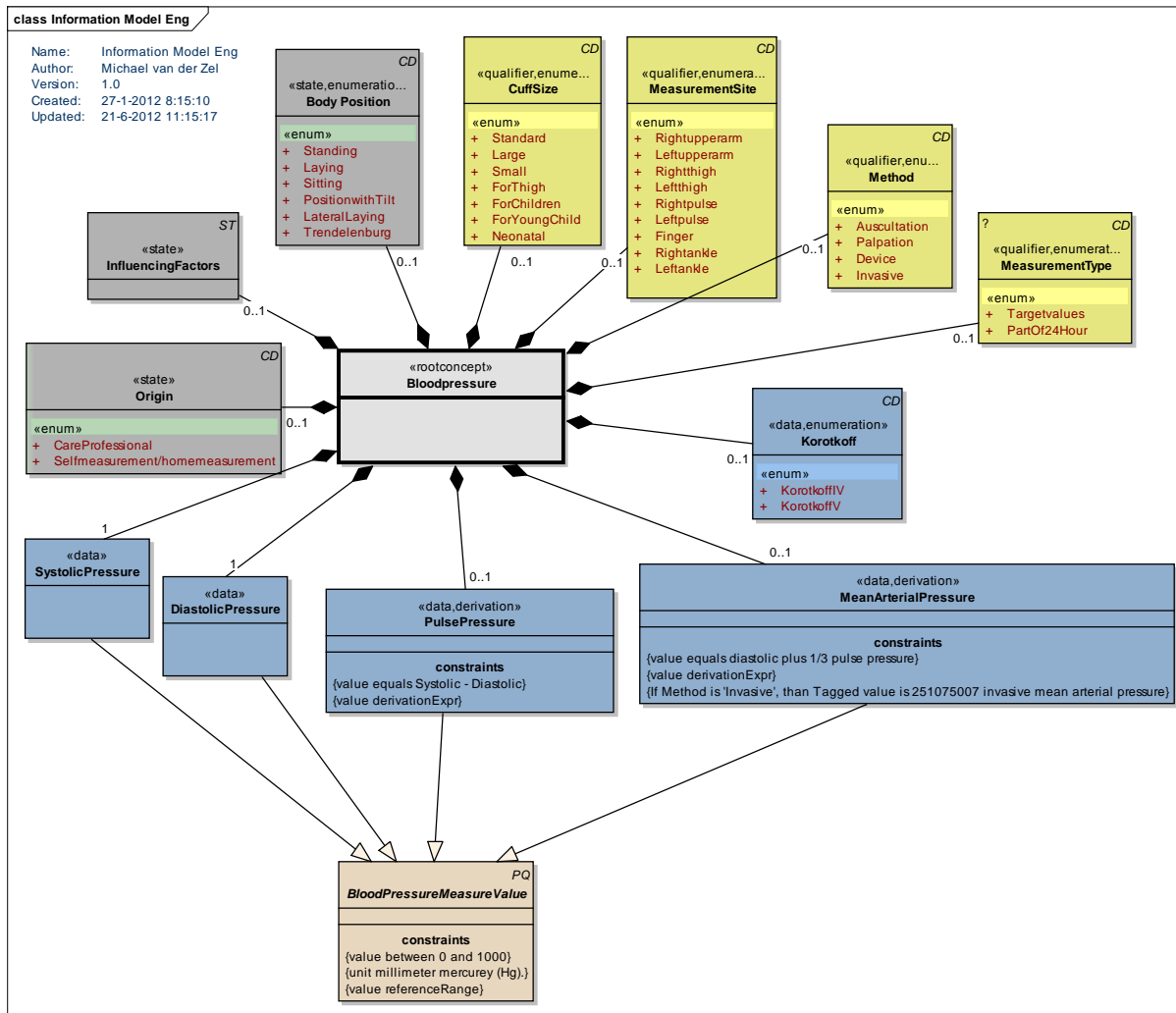
Circumstances for measuring blood pressure

The blood pressure is a frequently measured observation in different settings in health care. In the hospital the blood pressure will be measured routinely. The atmittance value is used as a baseline. In case there is a condition of the heart or too high or too low blood pressure, it will be frequently measured (Sesink en Kersten, 2006). Also, te blood pressure can be measured during 24 hour (NHG, 2011, NHG 2012).

The blood pressure can also be measured by people themselves in case the blood pressure has to be measured frequently or has to be measured 24 hour ambulant. People need to use a validated and calibrated blood pressure meter (NHG, 2011, NHG, 2012). After a surgery the blood pressure will have to be checked frequently until the patient is stable. (Sesink en Kersten, 2006).

It is possible to measure the blood pressure while the patient is in different postions, sich as laying, sitting or standing. Also, the blood pressure can be measured while in motion, or alternatively, when just awake.

1.7 Information Model English



Concept	Definition
InfluencingFactors SCT: 25618008, SnomedCT: 25618008	Factors that (incidentally) influence the blood pressure and the measuring of the blood pressure . For instance fear, pain, fever.

Concept	Definition
Korotkoff SCT: 85549003 Korotkoff sounds	Documenting which Korotkoff sound is used for the determination of the diastolic blood pressure when using auscultation. KorotkoffIV The sound tones get duller SCT:258201003 Type 4 KorotkoffV Silence: because the blood streams during both the systole and the diastole through the arteries, there is no turbulence and hence no sounds . SCT: 278358004 Type 5

Concept	Definition
MeasurementType Missing code: << >>	Type of measurement applied to measure the blood pressure Targetvalues PartOf24Hour

Concept	Definition
Method SCT: 260686004 method (attribute)	The method used to measure the blood pressure Auscultation Use of stethoscope and Korotkoff sounds SCT:code 37931006 auscultation (procedure) Palpation Use of palpation, usually at the arteria brachialis or arteria radialis. SCT:code 113011001 palpation (procedure) Device Measuring the blood pressure externally using a medical device. SCT: 63653004 biomedical device Invasive Invasive measure of the blood pressure using a catheter in the blood vessels. SCT: 77938009 arterial pressure monitoring, invasive method

Concept	Definition
Origin SnomedCT: 307117005 place of origin	The kind of person that carried out the blood pressure measure CareProfessional SnomedCT: 308522003 clinic monitoring status Selfmeasurement/homemeasurement SnomedCT: 410392000 housing surveillance, SnomedCT: 310858007 self-monitoring

Concept	Definition
Bloodpressure LOINC: 35094-2 Blood pressure panel, SCT: 75367002 blood pressure	The measuring of the blood pressure. Note this is the activity, not to be confused with the blood pressure measurement and values, that result from the activity.

Concept	Definition
Body Position SCT: 397155001 body position	A subset of the total set of body positions relevant to blood pressure measure Standing SCT: 10904000 orthostatic body position Laying SCT: 102538003 recumbent body position Sitting SCT: 33586001 sitting position PositionwithTilt SCT: 272587006 position with tilt LateralLaying SCT: 1227919013 lateral position Trendelenburg SCT: 34106002 Trendelenburg position

Concept	Definition
SystolicPressure SCT: 271649006 systolic blood pressure	The maximum pressure build up in the aorta when the left ventricle of the heart contracts.
Constraint	If method is 'Invasive' than tagged value 251071003 invasive systolic arterial pressure

Concept	Definition
MeanArterialPressure SCT: 251074006 non-invasive mean arterial pressure	The mean arterial blood pressure during a single cycle of the heart. The estimate of the value in mmHg is calculated with the following formula: diastolic pressure + 1/3 pulse pressure.
Constraint	value equals diastolic plus 1/3 pulse pressure <div>inv:value=DiastolicPressure +(PulsePressure/3)</div>
Constraint	value derivationExpr <div>((/hl7:observation[hl7:code/@code='271649006']/hl7:value/@value * 2 + (/hl7:observation[hl7:code/@code='271650006']/hl7:value/@value) div 3</div>
Constraint	If Method is 'Invasive', than Tagged value is 251075007

invasive mean arterial
pressure

Concept	Definition
CuffSize SCT: 70665002 blood pressure cuff	<p>The cuff size used to measure the blood pressure.</p> <p>Standard R4C: DCMR4C2-2 Standard cuff size for adults (cuff size 16 x 30 cm)</p> <p>Large R4C: DCMR4C2-3 Adult cuff size for an arm circumference of 35 to 44 cm (cuff size 16 x 36 cm).</p> <p>Small R4C: DCMR4C2-4 Adult cuff size for an arm circumference of 22 to 26 cm (cuff size 12 x 22 cm)</p> <p>ForThigh R4C: DCMR4C2-5 Adult cuff size for a thighbone when the arm circumference is 45 to 52 cm (cuff size 16 x 42 cm)</p> <p>ForChildren R4C: DCMR4C2-6 A cuff size for children of adults with a thin arm (cuff size about 8 x 21 cm)</p> <p>ForYoungChild R4C: DCMR4C2-7 A cuff size for young / small children (cuff size about 5 x 15 cm).</p> <p>Neonatal R4C: DCMR4C2-8 A cuff size for neonates (cuff size about 3 x 6 cm).</p>

Concept	Definition
MeasurementSite SCT: 397987002 measurement site	<p>The body site where the blood pressure is measured</p> <p>Rightupperarm SCT: 368209003 right upper arm structure</p> <p>Leftupperarm SCT: 368208006 left upper arm structure</p> <p>Rightthigh SCT: 11207009 structure of right thigh</p> <p>Leftthigh SCT: 209672000 entire left thigh</p> <p>Rightpulse SCT: 9736006 structure of right wrist</p> <p>Leftpulse SCT: 368236001 entire left wrist</p> <p>Finger SCT: 7569003 finger structure</p> <p>Rightankle SCT: 241699003 entire right ankle</p> <p>Leftankle SCT: 241784008 entire left ankle</p>

Concept	Definition
DiastolicPressure	The minimum pressure that exists between two contractions of the

SCT: 271650006 diastolic blood pressure	heart, when it fills itself again with blood.	
Constraint	If Method is 'Invasive', than tagged value is 251073000 invasive diastolic arterial pressure	

Concept	Definition	
PulsePressure SCT: 87179004 arterial pulse pressure	The difference between systolic and diastolic pressure during 1 cycle of the heart contraction. The pulse pressure gives an indication for the risk for cardiovascular diseases (Bolk, z.d.).	
Constraint	value equals Systolic - Diastolic	inv:value=Systolic-Diastolic
Constraint	value derivationExpr	//hl7:observation[hl7:code/@code='271649006']/hl7:value/@value - //hl7:observation[hl7:code/@code='271650006']/hl7:value/@value

Concept	Definition	
BloodPressureMeasureValue	An amount with unit mm Hg between 0 and 1000	
Constraint	value between 0 and 1000	inv:value>0 and value<1000
Constraint	unit millimeter mercury (Hg).	inv:unit='mmHg'
Constraint	value referenceRange	hl7:value[@value>0 and @value<1000]

1.8 Example Instances

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1.9 Instructions

The blood pressure is preferably measured at the arm. If there is lymphoedema, injury or intravenous drip the blood pressure may not be measured on that arm. (Sesink et.al, 2006).

Choose the right blood pressure meter with the right size of cuff. This depends on the site where the blood pressure is measured, whether it concerns an adult, child or neonate and/or the weight of a person. The 'ideal' cuff has to have a length of 80% of the perimeter of the arm and a width of 40 % of the perimeter of the arm.

The preferred cuff sizes are (Pickering et.al., 2005):

- For a perimeter of an arm of 22 to 26 cm, a cuff 'small' adults (12 x 22 cm).
- For a perimeter of an arm of 27 to 34 cm, a cuff for adults (16 x 30 cm).
- For a perimeter of an arm of 35 to 44 cm, a cuff 'large' adults (16 x 36 cm).
- For a perimeter of an arm of 45 to 52 cm, a cuff 'adult thigh' (16 x 42 cm).

Also pay attention to the position of the patient (lying, sitting and arm position) during the measurement of the blood pressure (TVPO, 2007; Langewouters, 1995; Pickering et.al., 2005). For diabetic care it should be considered to measure the blood pressure while the patient is in a sitting position.

The first measure is carried out on both arms. The highest value is documented and which arm it is measured. Next time, the measure is carried out on the same arm. There is no need to measure both arms again (NHG CVRM standaard 2012).

Anxiety during the measurement of blood pressure will be taken into account. The blood pressure should be measured under similar circumstances: time, same arm, similar environment (TVPO). The white coat phenomena is frequently occurring to patients. The presence of the doctor causes some anxiety that someone is often not aware of (Langewouters, 1995; Pickering et.al., 2005).

1.10 Interpretation

What is considered a 'normal' blood pressure is depending on several factors such as age, health condition and risk factors, for example heart and vascular diseases, diabetes (www.riskcare.nl, 2008). In Sesink et.al (2006) the following overview of blood pressure development during the life cycle is given.

Age	Blood pressure (mmHg)
Baby's	90/60
Children	110/60
Adult females	115/75
Adult males	120/80
Elderly	165/90

A reliable measure of the blood pressure is important to determine or adjust the medical treatment. The blood pressure is documented in the patient record.

Blood pressure measurement in daily practice. In the daily practice the blood pressure is measured by a doctor, nurse, assistant, allied health professional or in the hospital (doctors office measurement), or by the patient his/herself at home (home measurement). Ambulant blood pressure measures are carried out repeatedly and automatically (e.g. every half hour) during a period (e.g. 24 hours) outside the setting of

the hospital or the gp office. Comparable studies revealed that the result of a office measure has an average value of 10 / 7 mm Hg higher compared to standardized measures (NHG, 2011). It is advised to use an

optimal standardized method to measure the blood pressure in case of borderline values. The blood pressure values from gp office measures are on average higher than values from ambulant and home measures.

For risk assessment the value from the gp office is used.

Treatment of high blood pressure can be based on the following table with target values (NHG, 2011).

Table. Target values depending on blood pressure measurement type

Method	Target Value Systolic Blood Pressure
gp office	smaller than or equal to 140 mmHg (for the 80 plus 150-160 mmHg)
Home, protocol based	smaller than or equal to 135 mmHg
Ambulant, 24 hour	smaller than or equal to 130 mmHg

A strongly elevated blood pressure or symptoms can point to hypertensive crisis (hypertension with acute (aggravation of) damage to brain, heart, kidneys, large blood vessels and eyes, or to secondary hypertension (note 15).

Whether or not acute or progressive signs of organ damage determines the speed of treatment. Severe hypertension without symptoms or acute organ damage is not an hypertensive crisis, but a risk factor for cardiovascular diseases.

1.11 Care Process

The measuring of the arterial blood pressure of a person is part of the physical examination and can be done once or repeatedly depending on the health situation of a person. Together with other parameters the blood pressure gives an insight in the risk on heart and vascular diseases.

1.12 Example of the Instrument

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1.13 Constraints

For diabetic care the measurement in a sitting position is required.

1.14 Issues

No SCT or LOINC code for MeasurementType could be found at this stage.

In addition, since this DCM is used for production data in the SHB environment, the legacy system precoordinated codes are included. For instance the target value for systolic blood pressure has a SHB code. In the information model this is modelled such that at runtime the exact code must be assigned. Similarly for the Snomed CT coding.

Target Value Systolic Bloodpressure:

- SHB coding STRRRSYS
- No code in NHG lab.code table
- Snomed CT code 315612005 target systolic blood pressure

Target Value Diastolic Bloodpressure:

- SHB coding STRRRDIA
- No code in NHG lab.code table
- Snomed CT code 315613000 target diastolic blood pressure

Besides this, for the 24 hr blood pressure measure, we created a separate DCM: 24UursBloeddrukMeting. (In Dutch only june 2012).

Origin of measure: SCT code housing surveillance might not be the proper option.

1.15 References

Projects:

DCM Blood pressure has been created for the Nictiz e-Diabetes project. nl.Nictiz.Bloeddruk-v0.99 (nl)(xmi 1.1). This DCM is based on that and augmented with OLVG and SHB requirements.

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Vocabulary:

SNOMED CT 2.16.840.1.113883.6.96

LOINC 2.16.840.113883.6.1

SHB Codesystem

NHG ICPC-1-2000NL 2.16.840.1.113883.2.4.4.31.1

It is possible that others in this domain use other coding and value sets than those used in this DCM. If that is the case, Health Base would appreciate it to be informed about that.

For the coding we have used preferred codings systems such as NHG Labcode, Snomed CT en LOINC, or one of the WHO family of classifications (ICPC, ICD10, ICF, ICNP).

Also, Health Base have used their own internal codes. These are for Health Base the best possible match between the data element (item, variable or value set) and the concept(s) as included in such a terminology or classification

In some cases a more strict analysis of one of these terminologies could reveal variations that are equal or even better matches, for instance from another perspective. Therefore, there is a small chance that in the future minor changes will take place for some data elements. Where we could not find a code, only internal codes are used and the missing concepts will be submitted to Snomed CT.

1.16 Functional Model

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1.17 Traceability to other Standards

In the Dutch situation this material is used in several projects. Both the NDF Report Content e-Diabetes Dataset as the e-Diabetes core data set include data elements from this DCM.

1.18 Disclaimer

Health Base, OLVG, Nictiz, Parelsnoer Instituut and Results 4 Care in their respective roles give utmost care to the reliability and timeliness of data in this DCM (Detailed Clinical Model). Errors and inaccuracies may occur.

Health Base, OLVG, Nictiz, Parelsnoer Instituut, and Results 4 Care are not responsible for damages resulting from errors or inaccuracies in the information. Neither do Health Base, OLVG, Nictiz, Parelsnoer Instituut, and Results 4 Care accept any responsibility 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 means of a website, by e-mail, or otherwise electronically. Health Base, OLVG, Nictiz, Parelsnoer Instituut, and Results 4 Care do not accept any responsibility for possible or actual damage suffered as a result of the use of data, advice or ideas provided in this DCM.

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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.

1.19 Terms of Use

The DCM is open source, so free to use, however, only if it is not changed.

Changes in the content en codes are seen upon as a infringement of copyright and is damaging for the goal of use: realization of semantic interoperability.

You can suggest changes at info@healthbase.nl with reference to the DCM topic. These suggestions will be assessed by Health Base.

Revision suggestions will be looked at and may lead to:

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

Health Base will inform the requester about this.

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

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