CHRIS Study

Interview – Cardiovascular diseases

Version 1.0

23rd November 2021

Authors: LB, MG, LF

1. Introduction

This module stores information derived from the birth, myocardial infarction, heart failure, cardiac arrhythmia, and circulation information, that was collected at the interview, as well as from the resting ECG 10s recordings, the medication packages scanned.

Participants book a morning appointment at the CHRIS study center, ranging from 7.45 to 8.45 a.m. Each study participant is assigned a workflow at the reception. If there are ten study participants (maximum capacity), there are ten different workflows, marked with the letters from "A" to "K". The current workflow is as follows: A-B-C-D-E-F-G-H-I-K. All the workflows can be found in the documentation of CHRIS Baseline/General information/Administrative data, in the file named "Workflows at baseline assessment". The interview occurs always after the spiralography and the blood drawing, for most as the last session, after the ECG assessment and the self-administered questionnaire (workflows B, C, E, F, H, I, L). For the remainder, the interview occurs after breakfast and just before the self-administered questionnaire (workflows A and G) or in between the blood drawing and the anthropometry (workflow D).

The interview full text and its corresponding answer lists are available at CHRIS Baseline/Interview, whereas the resting ECG 10s are stored in CHRIS Baseline/Clinical traits/Resting ECG/ECG 10s.

2. History version changes

This module is composed of derived variables, so the various versions depend on when the different modules changed their version.

Version 1: from August 24th, 2011, to November 4th, 2012, x0miver=1, x0hfver=1, x0afver=1, CI module not in use yet, x0biver=1, x0otver=1

Version 2: from November 5th, 2012, to December 7th, 2012, x0miver=2, x0hfver=2, x0afver=2, x0civer=1, x0biver=2, x0otver=2

Version 3: from December 10th, 2012, to August 29th, 2014, x0miver=2, x0hfver=2, x0afver=2, x0civer=2, x0biver=2 or 3, x0otver=2

Version 4: from September 1st, 2014, to December 21st, 2018, x0miver=3, x0hfver=2, x0afver=2, x0civer=1, x0biver=3, x0otver=2

3. Data cleaning

1. The main CHRIS dataset was loaded.
2. The last questions of the cardiac arrhythmia module, x0af12, x0af12a and x0afn6, were renamed as **x0cv01**, **x0cv01a**, and **x0cvn1**, given they referred to other heart diseases and not cardiac arrhythmia.
3. The variable on other cardiac diseases, x0cv01, had its missing observations transformed into:
    a) "Not in use" if the version was the first,

b) "Unexpected missing" otherwise.

4. Based on sex, age, total cholesterol, HDL cholesterol, current smoking status, and systolic blood pressure, the Framingham Risk score, and the Framingham Risk 10-year risk score were computed and saved, respectively, as **x0cv02** and **x0cv03**. For the 10-year risk score, individuals with previous stroke/transient ischemic attack, bypass surgery, balloon angioplasty, type 2 diabetes, chronic kidney disease, or peripheral artery disease were considered to be at high risk.
5. From the variable x0mi08 on coronary artery disease (CAD), a cleaned version was created with either diagnosed Coronary Artery Disease (CAD) or bypass or angioplasty/stent required to treat coronary stenosis (x0mi08="Yes" or x0mi18="Yes" or Stent reported in x0min*, x0afn*, x0hfn*). Note that myocardial infarction (x0mi09) was **not** included here, since myocardial infarction can occur in the absence of CAD. It was saved as **x0cv04**.
6. The presence of atherosclerosis of other big arteries (e.g. carotis, femoralis) was derived based on all the free text variables and the notes of the modules x0mi*, x0af*, x0hf*, x0ci*. It was then saved as **x0cv05**.
7. The presence of any ischemic heart disease, including clean CAD, stenosis of other big arteries, myocardial infarction, angina pectoris (x0cv4="Yes" or x0cv05="Yes" or x0mi09="Yes" or "angina pectoris" reported in free text variables or reported assumption of drugs for angina treatment, i.e. ATC codes starting with C01D - vasodilators), was derived and saved as **x0cv06**. Furthermore, artery calcification was excluded.
8. The presence of any artery calcification was derived based on on all the free text variables and the notes of the modules x0mi*, x0af*, x0hf*, x0ci*. It was then saved as **x0cv07**.
9. A cleaned version of the variable heart failure, x0mi09, was derived combining birth defects, myocardial diseases, heart defects, and any other heart disease (x0bi06a, x0hf05, x0hf06, x0cv01a) with the notes and free-txt variables. It was saved as **x0cv08**.
10. Using the variables on birth defects, myocardial diseases, heart defects, and any other heart disease (x0bi06a, x0hf05, x0hf06, x0cv01a), the presence of any structural heart defect from birth was derived and saved as **x0cv09**. This includes Patent Foramen Ovale, septum defects, ductus arteriosus (ductus Botalli), Fallot tetralogy, transposition of the big vessels.
11. A cleaned version of cardiac inflammation was created based on self-report of myocarditis in x0hf04 and x0hf04c, as well as all other free-text and notes variables. This includes cardiac inflammation due to infective causes, like myocarditis, pericarditis, endocarditis and was saved as **x0cv10**.
12. A clean version of cardiomyopathy was created combining self-report of cardiomyopathy in x0hf05 and x0hf05c, as well as all other free-text and notes variables. It includes well defined cardiomyopathies (e.g. AVC, Takotsubo) and generic heart enlargement (cause is not specified, likely to be hypertensive cardiomyopathy). It was saved as **x0cv11**.
13. A variable on generic valve disease was created combining the variables x0af01, x0bi06a, x0hf05, x0hf06, x0cv01a. It was not always possible to distinguish between valve type (e.g. mitral vs aorta) or the onset (e.g. since birth, acquired due to infective causes - rheumatic disease). Reparative surgery might have been performed. It was saved as **x0cv12**.
14. The heart defect patent foramen ovale, also known in German as "Loch im Herzen", was stored in a specific variable, named **x0cv13**, based on the variables x0bi06a, x0hf05, x0hf06, and x0cv01a.

15. The diagnosis of atrial fibrillation, already assessed directly in x0af02a, was further refined in a new variable called **x0cv14**, combining information from x0af02a, as well as any reference to "*Vorhofflimmern*" or "*VHF*" or "*Flimmern*" in the modules x0af*, x0hf*, x0mi*, x0ci*, x0ot*, and the birth defects stored in x0bi6a.
16. An additional variable on atrial fibrillation was created assigning atrial fibrillation to anyone with x0cv14="Yes" and anyone with a P-wave length of 0 in the 10 seconds ECG. It was saved as **x0cv14a**.
17. Given the question on sudden cardiac arrest with loss of consciousness, x0af09, was often interpreted as any loss of consciousness, a clean version of this variable was created to classify the event and its cause. Cardiac arrest was considered due to primary cardiac reason (e.g. arrhythmia, myocardial infarction) in presence of resuscitation. Cardiac arrest secondary to other severe conditions - as anaphylaxis, complication of surgery, complication during pregnancy or delivery, trauma, haemorrhage, infection, unclear memory, was separately labelled. Therefore, "cardiac arrest" without any resuscitation procedure (typically under stress/emotion) was considered as TLOC (Transient Loss Of Consciousness) due to cerebral hypoperfusion, characterized by a rapid onset, short duration, and spontaneous complete recovery. It was saved as **x0cv15**.
18. A variable on any type of cardiac arrest was generated combining x0af09, x0af09a, x0af10 (resuscitation), with notes and free text examination. It includes all cardiac arrests and likely TLOC (syncope with no resuscitation) due to primary or secondary cardiac reason. It was saved as **x0cv15a**.
19. The presence of any other arrhythmias, excluding sudden cardiac arrest of x0cv15, was derived based on notes and free text examination. It includes atrial fibrillation, shock therapy, synus sick disease, carrier of a pacemaker or an implantable cardioverter defibrillator, Wolff-Parkinson-White syndrome, Left Bundle-Branch Block, Right Bundle-Branch Block, atrioventricular canal defect (AVC), atrioventricular block. It was saved as **x0cv16**.
20. Furthermore, a variable describing the presence of all defined arrhythmias of x0cv16 and including sudden cardiac arrest of x0cv15 was created. It was saved as **x0cv17**.
21. Another variable that included any kind of arrhythmia was created and saved as **x0cv18**.
22. The presence of at least one cardiovascular disease was derived from notes and free text variables and included ischemic diseases, arrhythmic diseases (excluding palpitations), myocarditis, cardiomyopathy, heart failure, valve problems, birth defects. It was saved as **x0cv19**.
23. The presence of at least one cardiovascular problem of any kind was derived from notes and free text variables and included ischemic diseases, any arrhythmic problem (including palpitations), myocarditis, cardiomyopathy, heart failure, valve problems, birth defects, any heart surgery, murmur, any other unspecified heart problem. It was saved as **x0cv20**.
24. A categorical summary variable on various specific cardiovascular diseases was created based on the notes and free text examination of the modules x0af*, x0mi*, x0hf*, x0ci*, x0ot*, and x0bi06a. "No special disease", "AVC", "Wolff-Parkinson-White syndrome", "LBBB", "RBBB", "Takotsubo cardiomyopathy", "Pectus excavatum", "Artery dissection", "Pseudoxantoma elasticum", "Aneurysm", "Fallot tetralogy", "Ductus Botalli", "Transposition of the great vessels". It was saved as **x0cv21**.

25. The presence of Wolff-Parkinson-White syndrome was derived from notes and free text variables and saved as **x0cv22**.
26. The presence of right of left Bundle-Branch Block was derived from notes and free text variables and saved as **x0cv23**.
27. The presence of right of left Bundle-Branch Block was derived if x0cv23 was “Yes” or the QRS time of the 10 seconds ECG was longer than 120 ms. It was saved as **x0cv23a**.
28. The presence of arrythmias, including sudden cardiac arrest (x0cv14a), atrial fibrillation (x0cv17), and Bundle-Branch Block (x0cv23a), was combined in a single variable, called **x0cv24**.
29. The free text variables describing other heart diseases/problems, x0cv01a, x0cvn1, and x0cvnote, were translated and categorized when possible.
30. The baseline dataset was saved.

4. Data structure

The variables listed in table 1 constitute all the variables related to the cardiovascular system, that were derived from the modules myocardial infarction, heart failure, cardiac arrhythmias, birth, circulation, and other diseases of the interview, the resting ECG 10s, and the medications scanned at the CHRIS center.

Table 1. Cardiovascular variables list

Variable	Description	Coding	Filter	Notes	Version	Available	Derived
x0cv01	Have you or had you in the past any other diseases of the heart we did not mention yet?	1 Yes 2 No			2,3,4	Yes	No
x0cv01a	Describe the diseases of the heart as accurately as possible	<character>	x0cv01=1		2,3,4	Yes	No
x0cv01a2	Describe the diseases of the heart as accurately as possible	<character>	x0cv01=1	Translation and categorization of x0cv01a	2,3,4	Yes	Yes
x0cv02	Framingham Risk Score	<integer>		It ranges from -10 to +28	1,2,3,4	No	Yes
x0cv03	Framingham Risk Score, 10-Year Risk (%)	<character>			1,2,3,4	No	Yes
x0cv04	Clean Coronary Artery Disease (CAD)	1 Yes 2 No		Coronary Artery Disease (CAD) or bypass or angioplasty/stent required to treat coronary stenosis.	1,2,3,4	Yes	Yes
x0cv05	Presence of atherosclerosis of other big arteries (e.g. carotis, femoralis)	1 Yes 2 No		Generated from notes and free text examination	1,2,3,4	Yes	Yes
x0cv06	Any ischemic heart disease	1 Yes 2 No		Conditions included: CAD (see x0cv04), stenosis of other big arteries, myocardial infarction, angina pectoris.	1,2,3,4	Yes	Yes
x0cv07	Any artery calcification	1 Yes 2 No		Generated from notes and free text examination. Note that artery calcification is not included in “any ischemic heart disease” of x0cv06.	1,2,3,4	Yes	Yes

Variable	Description	Coding	Filter	Notes	Version	Available	Derived
x0cv08	Clean heart failure	1 Yes 2 No		Generated combining x0bi06a, x0hf05, x0hf06, x0af12a with notes and free text examination.	1,2,3,4	Yes	Yes
x0cv09	Any structural heart defect from birth	1 Yes 2 No		Generated combining x0bi06a, x0hf05, x0hf06, x0af12a with notes and free text examination.	1,2,3,4	Yes	Yes
x0cv10	Clean cardiac inflammation	1 Yes 2 No		Generated combining x0hf04 and x0hf04c with notes and free-txt examination. Includes cardiac inflammation due to infective causes, like myocarditis, pericarditis, endocarditis	1,2,3,4	Yes	Yes
x0cv11	Clean cardiomyopathy	1 Yes 2 No		Generated combining x0hf05 and x0hf05c with notes and free-txt examination. Includes well defined cardiomyopathies (e.g. AVC, Takotsubo) and generic heart enlargement (cause is not specified, likely to be hypertensive cardiomyopathy)	1,2,3,4	Yes	Yes
x0cv12	Valve disease	1 Yes 2 No		Generated combining x0af01, x0bi06a, x0hf05, x0hf06, x0af12a. Cannot distinguish between valve type or the onset.	1,2,3,4	Yes	Yes
x0cv013	Patent Foramen Ovale (PFO)	1 Yes 2 No		Generated combining x0bi06a, x0hf05, x0hf06, x0af12a with notes and free-txt examination.	1,2,3,4	Yes	Yes
x0cv14	Clean Atrial Fibrillation (AF)	1 Yes 2 No		Generated combining x0af02a with notes and free-txt examination (keywords: "Vorhofflimmern", "Flimmern", “VHF“).	1,2,3,4	Yes	Yes
x0cv14a	Clean Atrial Fibrillation (AF) + 10sec ECG	1 Yes 2 No		Generated combining x0af02a with notes and free-txt examination. Additionally, AF=yes if P wave length (10sec ECG) = 0	1,2,3,4	Yes	Yes
x0cv15	Clean Sudden Cardiac Arrest (SCA) by LF	1 Cardiac arrest of likely arrhythmic origin 2 Likely Transient Loss of Consciousness (TLOC) 3 Cardiac arrest requiring resuscitation, due to secondary cause		Generated combining x0af09, x0af09a with notes and free text examination (keyword: "Herzstillstand, Ohnmacht"). Cardiac arrest is considered due to primary cardiac reason (e.g. arrhythmia, myocardial infarction) in presence of resuscitation. Syncope yes, res yes → cardiac arrest of arrhytm origin Syncope yes, res no→ 2 Syncope no, res no → no cardiac arrest	1,2,3,4	Yes	Yes

Variable	Description	Coding	Filter	Notes	Version	Available	Derived
		4 Cardiac arrest requiring resuscitation, unclear cause		Syncope yes, res yes, but during surgery, due to trauma, delivery, epilepsy, intoxication→ 3 (Syncope yes, res yes, defibrillator/pacemaker reported) OR (res yes, syncope NA) → 4			
x0cv15	Clean Sudden Cardiac Arrest (SCA) by MG	1 Yes 2 No		Generated combining x0af09, x0af09a with notes and free text examination (keyword: "Herzstillstand, Ohnmacht"). Cardiac arrest is considered due to primary cardiac reason (e.g. arrhythmia, myocardial infarction) in presence of resuscitation. Syncope yes, res yes → cardiac arrest of arrhytm origin Syncope yes, res no→ 2 Syncope no, res no → no cardiac arrest Syncope yes, res yes, but during surgery, due to trauma, delivery, epilepsy, intoxication→ 3 (Syncope yes, res yes, defibrillator/pacemaker reported) OR (res yes, syncope NA) → 4	1,2,3,4	Yes	Yes
x0cv15a	Sudden Cardiac Arrest - all	1 Yes 2 No		Generated combining x0af09, x0af09a with notes and free text examination. Includes all cardiac arrests and likely TLOC (syncope with no resuscitation) due to primary or secondary cardiac reason.	1,2,3,4	Yes	Yes
x0cv16	Presence of arrhythmias - excluding SCA (x0af14)	1 Yes 2 No		Conditions included: AF, shock therapy, pacemaker or ICD carrier, WPW-syndrome, LBBB, RBBB, AVC, AV block	1,2,3,4	Yes	Yes
x0cv17	Presence of arrhythmias - including SCA	1 Yes 2 No		Identical to x0af15, apart from SCA (included)	1,2,3,4	Yes	Yes
x0cv18	Presence of any kind of arrhythmia	1 Yes 2 No		Any arrhythmic problem of any kind	1,2,3,4	Yes	Yes
x0cv19	Presence of at least one cardiovascular disease	1 Yes 2 No		Conditions included: ischemic diseases, arrhythmic diseases (excluding palpitations), myocarditis, cardiomyopathy, heart failure, valve problems, birth defects	1,2,3,4	Yes	Yes

Variable	Description	Coding	Filter	Notes	Version	Available	Derived
x0cv20	Presence of at least one cardiovascular problem of any kind	1 Yes 2 No		Conditions included: ischemic diseases, any arrhythmic problem (including palpitations), myocarditis, cardiomyopathy, heart failure, valve problems, birth defects, any heart surgery, murmur, any other unspecified heart problem	1,2,3,4	Yes	Yes
x0cv21	Presence of specific cardiovascular diseases / disease impacting the cardiac function	1 Arrhythmogenic Ventricular Cardiomyopathy (AVC) 2 Wolff-Parkinson-White (WPW) syndrome 3 Left Bundle Branch Block (LBBB) 4 Right Bundle Branch Block (RBBB) 5 Takotsubo cardiomyopathy 6 Pectus excavatum 7 Artery dissection 8 Pseudoxantoma elasticum 9 Aneurysm 10 Fallot tetralogy 11 Ductus Botalli 12 Transposition of the great vessels 13 Dilated cardiomyopathy 14 Unspecified familial cardiomyopathy, sisters heart-transplanted		Generated from notes and free-txt examination	1,2,3,4	Yes	Yes
x0cv22	Wolff-Parkinson-White syndrome	1 Yes 2 No		Generated from notes and free-txt examination.	1,2,3,4	Yes	Yes
x0cv23	Right or Left Bundle Branch Block - from interview	1 Yes 2 No		Generated from notes and free-txt examination.	1,2,3,4	Yes	Yes

Variable	Description	Coding	Filter	Notes	Version	Available	Derived
x0cv23a	Right or Left Bundle Branch Block - from interview + 10sec ECG	1 Yes 2 No		Generated from notes, free-txt examination. Additionally, BBB=yes if QRS>120 ms.	1,2,3,4	Yes	Yes
x0cv24	Presence of arrhythmias - including SCA + AF and BBB - additionally derived from ECG	1 Yes 2 No		Combination of x0af13a, x0af16, x0af22a	1,2,3,4	Yes	Yes
x0cvn1	Cardiovascular notes (other heart disease)	<character>			1,2,3,4	Yes	Yes
x0cvnote	Cardiovascular notes	<character>		Copied from x0afnote, when not related to x0af* questions	1,2,3,4	Yes	Yes
x0cvver	Cardiovascular version	1 First 2 Second 3 Third 4 Fourth		Combination of x0miver, x0hfver, x0afver, x0civer, x0otver, x0biver.	1,2,3,4	Yes	Yes

5. Advices for the analysis

The analyst should consider that:

- information derived from free text has **limitations**, and it is particularly affected by recall bias. Information can be difficult to recall, in particular when it deals with more clinical domains (e.g. x0cv05).
- composite outcome variables~~, like x0cv06 (any ischemic disease), are **for internal use** only. They have been built to group diseases of the same type and to generate summary statistics. They~~ do not necessarily correspond to any standardized derived variable previously published.

The current medications can be looked at in the drugs module x0dd*, where the participant let their current medication packages be scanned by the nurse at the study center. Specifically, the variable x0dd30 describes current use of vasodilators (used for instance for angina pectoris), the variable x0dd36 describes the use of antithrombotics.

Should the analyst want to compute the Framingham Heart Risk Score, they should recall that blood pressure was measured with two different machines and saved in separate sets of variables. For instance, the average systolic blood pressure measured with the first device is saved in x0bp01, whereas the average systolic blood pressure measured with the second device is saved in x0bp11 (CHRIS Baseline/Clinical traits/Blood pressure).

Finally, the analyst should always take into account that the operator in charge of carrying out the interview might have influenced how the participant reported their answers. The analyst should therefore adjust for the operator variable, x0_opintc, when possible.

6. References

Löwel H, Döring A, Schneider A, Heier M, Thorand B, Meisinger C. The MONICA Augsburg surveys - basis for prospective cohort studies. Gesundheitswesen. 2005;67(Sonderheft 1):S13–S18. doi: https://doi.org/10.1055/s-2005-858234

Holle R, Happich M, Löwel H, Wichmann H-E. KORA-A Research Platform for Population Based Health Research. Gesundheitswesen. 2005;67(Sonderheft 1):S19–S25. doi: https://doi.org/10.1055/s-2005-858235

Lloyd-Jones DM, Wilson PW, Larson MG, Beiser A, Leip EP, D'Agostino RB, Levy D. Framingham risk score and prediction of lifetime risk for coronary heart disease. Am J Cardiol. 2004 Jul 1;94(1):20-4. doi: https://doi.org/10.1016/j.amjcard.2004.03.023