Definitions of Acute Myocardial Infarction and Main Myocardial Infarction Pathological Types
UK Biobank Phase 1 Outcomes Adjudication

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Documentation prepared by:
Christian Schnier, Kathryn Bush, John Nolan, and Cathie Sudlow
On behalf of UK Biobank Outcome Adjudication Group

Definitions of Acute Myocardial Infarction, UK Biobank Phase 1 Outcomes Adjudication

Data sources on which the algorithm relies are UKB baseline assessment data (verbal interview); linked hospital admissions data (HES APC, SMR01, PEDW); death register data.

Definitions & Abbreviations:

MI	Acute Myocardial Infarction
STEMI	ST Elevation MI
NSTEMI	Non-ST Elevation MI
HES APC	Hospital Episode Statistics - Admitted Patient Care (England)
SMR01	Scottish Morbidity Records – General / Acute Inpatient and Day Case Admissions (Scotland)
PEDW	Patient Episode Database for Wales
EHR	Electronic Health Records
Finished Consultant Episode	The basic counting unit for statistics of admitted care Hospital EHR data (= a row of data in the data extracts provided) is a finished consultant episode (FCE).
Code date	The start date of the FCE is taken as the code date.
ICD 9	International Classification of Diseases, Version 9 (SMR only)
ICD 10	International Classification of Diseases, Version 10
Prevalent Case	First known hospitalisation with a relevant diagnostic code prior to recruitment, or self-reported event at recruitment.
Incident Case	First known hospitalisation with a relevant diagnostic code post recruitment, or cause-specific death, in those without indication of prevalent event as defined above.

Background:

A full list of the ICD and Biobank self-report codes used can be found in Table 1 at the end of this document.

The estimated accuracy of the algorithm is included in Appendix 1.

The use of self-report code dates is discussed in Appendix 2.

A. ACUTE MYOCARDIAL INFARCTION

(1) MI prior to baseline assessment ('prevalent MI')

(a) MI detected by hospital admission EHR (with or without self-report) : One (or more) of the MI ICD (9 or 10) listed in Table 1, in HES APC, SMR01 or PEDW linked records in the primary or any secondary position, with a code date prior to the date of baseline assessment.

(b) MI by self-report only: The participant has self-reported MI at baseline assessment, but without evidence of MI from linked HES APC, SMR01 or PEDW data (as defined above).

Setting the date of prevalent MI diagnosis:

- If a participant has both an ICD code and a self-report code, the ICD code date is used.
- If the participant has ICD code(s) only, the earliest ICD code date is used.
- If the participant has self-report code(s) only, the earliest self-reported date is used.
- Missing dates are set to 1/1/1900.

(2) MI following baseline assessment ('incident MI')

Excluding those with an MI prior to baseline assessment:

(a) MI detected by hospital admission EHR: One (or more) of the MI ICD (9 or 10) codes in HES APC, SMR01 or PEDW linked records, in the primary or any secondary position, with code date post the date of baseline assessment.

(b) MI detected by death register only: No ICD codes in HES APC, SMR01 or PEDW linked records, but one (or more) ICD codes in death register records, in the underlying cause or any other position.

Setting the date of incident MI diagnosis:

- If a participant has ICD codes in both hospital admission and death register records, the earliest recorded code date regardless of source is used.
- If ICD code(s) recorded in hospital admission only, the earliest ICD code date is used.
- If ICD code(s) recorded in death register only, the date of death is used.

B. ST ELEVATION MI

(1) STEMI prior to baseline assessment ('prevalent STEMI')

(a) STEMI detected by hospital admission EHR (with or without self-report) : One (or more) of the STEMI ICD (9 or 10) codes listed in Table 1, in HES APC, SMR01 or PEDW linked records in the primary or any secondary position where the code date is prior to the date of baseline assessment.

Setting the date of prevalent STEMI diagnosis:

- If the participant has more than one ICD code, the earliest ICD code date is used.

(2) STEMI following baseline assessment ('incident STEMI')

Excluding those with **any** MI prior to baseline assessment:

(a) STEMI detected by hospital admission EHR: One (or more) of the STEMI (9 or 10) codes in HES APC, SMR01 or PEDW linked records, in the primary or any secondary position, with code date post the date of baseline assessment.

(b) STEMI detected by death register only: No ICD codes in HES APC, SMR01 or PEDW linked records, but one (or more) ICD codes in death register records, in the underlying cause or any other position.

Setting the date of incident STEMI diagnosis:

- If a participant has ICD codes in both hospital admission and death register records, the earliest recorded code date regardless of source is used.
- If ICD code(s) recorded in hospital admission only, the earliest ICD code date is used.
- If ICD code(s) recorded in death register only, the date of death is used.

C. NON-ST ELEVATION MI

(1) NSTEMI prior to baseline assessment ('prevalent NSTEMI')

(a) NSTEMI detected by hospital admission EHR (with or without self-report) : One (or more) of the NSTEMI ICD (9 or 10) codes listed in Table 1, in HES APC, SMR01 or PEDW linked records in the primary or any secondary position where the code date is prior to the date of baseline assessment.

Setting the date of prevalent NSTEMI diagnosis:

- If the participant has more than one ICD code, the earliest ICD code date is used.

(2) NSTEMI following baseline assessment ('incident NSTEMI')

Excluding those with **any** MI prior to baseline assessment:

(a) NSTEMI detected by hospital admission EHR: One (or more) of the NSTEMI (9 or 10) codes in HES APC, SMR01 or PEDW linked records, in the primary or any secondary position, with code date post the date of baseline assessment.

(b) NSTEMI detected by death register only: No ICD codes in HES APC, SMR01 or PEDW linked records, but one (or more) ICD codes in death register records, in the underlying cause or any other position.

Setting the date of incident NSTEMI diagnosis:

- If a participant has ICD codes in both hospital admission and death register records, the earliest recorded code date regardless of source is used.
- If ICD code(s) recorded in hospital admission only, the earliest ICD code date is used.
- If ICD code(s) recorded in death register only, the date of death is used.

Table 1. Code Lists for Acute Myocardial Infarction

UK Biobank Self Report Codes					
Code Type	**Code**	**Biobank Code Text**	**STEMI**	**NSTEMI**	**MI**
UK Biobank Self Report	Field 20002 Code 1075	Heart attack/myocardial infarction			ü
ICD 9 Codes					
Code Type	**ICD 9 Code**	**ICD 9 Text**	**STEMI**	**NSTEMI**	**MI**
ICD 9 Code	410	Acute myocardial infarction			ü
ICD 9 Code	410.0	Acute myocardial infarction of anterolateral wall	ü		ü
ICD 9 Code	410.1	Acute myocardial infarction of other anterior wall	ü		ü
ICD 9 Code	410.2	Acute myocardial infarction of inferolateral wall	ü		ü
ICD 9 Code	410.3	Acute myocardial infarction of inferoposterior wall	ü		ü
ICD 9 Code	410.4	Acute myocardial infarction of other inferior wall	ü		ü
ICD 9 Code	410.5	Acute myocardial infarction of other lateral wall	ü		ü
ICD 9 Code	410.6	True posterior wall infarction	ü		ü
ICD 9 Code	410.7	Subendocardial infarction		ü	ü
ICD 9 Code	410.8	Acute myocardial infarction of other specified sites	ü		ü
ICD 9 Code	410.9	Acute myocardial infarction of unspecified site	ü		ü
ICD 9 Code	411	Other acute and subacute forms of ischaemic heart disease			ü
ICD 9 Code	411.0	Postmyocardial infarction syndrome			ü
ICD 9 Code	411.1	Intermediate coronary syndrome			ü
ICD 9 Code	411.8	Other			ü
ICD 9 Code	412.X	Old myocardial infarction			ü
ICD 9 Code	429.79	Ill-defined descriptions and complications of heart disease - Other			ü
ICD 10 Codes					
Code Type	**ICD 10 Code**	**ICD 10 Text**	**STEMI**	**NSTEMI**	**MI**
ICD 10 Code	I21	Acute myocardial infarction			ü
ICD 10 Code	I21.0	Acute transmural myocardial infarction of anterior wall	ü		ü
ICD 10 Codes Continued Overleaf					

ICD 10 Codes (Continued)					
Code Type	**ICD 10 Code**	**ICD 10 Text**	**STEMI**	**NSTEMI**	**MI**
ICD 10 Code	I21.1	Acute transmural myocardial infarction of inferior wall	ü		ü
ICD 10 Code	I21.2	Acute transmural myocardial infarction of other sites	ü		ü
ICD 10 Code	I21.3	Acute transmural myocardial infarction of unspecified site	ü		ü
ICD 10 Code	I21.4	Acute subendocardial myocardial infarction		ü	ü
ICD 10 Code	I21.9	Acute myocardial infarction, unspecified		ü	ü
ICD 10 Code	I22	Subsequent myocardial infarction			ü
ICD 10 Code	I22.0	Subsequent myocardial infarction of anterior wall	ü		ü
ICD 10 Code	I22.1	Subsequent myocardial infarction of inferior wall	ü		ü
ICD 10 Code	I22.8	Subsequent myocardial infarction of other sites	ü		ü
ICD 10 Code	I22.9	Subsequent myocardial infarction of unspecified site		ü	ü
ICD 10 Code	I23	Certain current complications following acute myocardial infarction			ü
ICD 10 Code	I23.0	Haemopericardium as current complication following acute myocardial infarction			ü
ICD 10 Code	I23.1	Atrial septal defect as current complication following acute myocardial infarction			ü
ICD 10 Code	I23.2	Ventricular septal defect as current complication following acute myocardial infarction			ü
ICD 10 Code	I23.3	Rupture of cardiac wall without haemopericardium as current complication following acute myocardial infarction			ü
ICD 10 Code	I23.4	Rupture of chordae tendineae as current complication following acute myocardial infarction			ü
ICD 10 Code	I23.5	Rupture of papillary muscle as current complication following acute myocardial infarction			ü
ICD 10 Code	I23.6	Thrombosis of atrium, auricular appendage, and ventricle as current complications following acute myocardial infarction			ü
ICD 10 Code	I23.8	Other current complications following acute myocardial infarction			ü
ICD 10 Code	I24.1	Dressler syndrome			ü
ICD 10 Code	I25.2	Old myocardial infarction			ü

Appendix 1

The estimated accuracy of algorithmically defined MI events is based on a systematic review of published studies conducted on behalf of the UK Biobank Cardiac Outcomes Group.

The selected ICD codes from hospital data are estimated to produce positive predictive values (PPVs):

- for any MI of 75-100%;
- for STEMI of 71-100%
- for NSTEMI of >90%

The PPV of MI events identified in death registry data only is likely to be somewhat lower (around 70-75%) than those identified in hospital records.

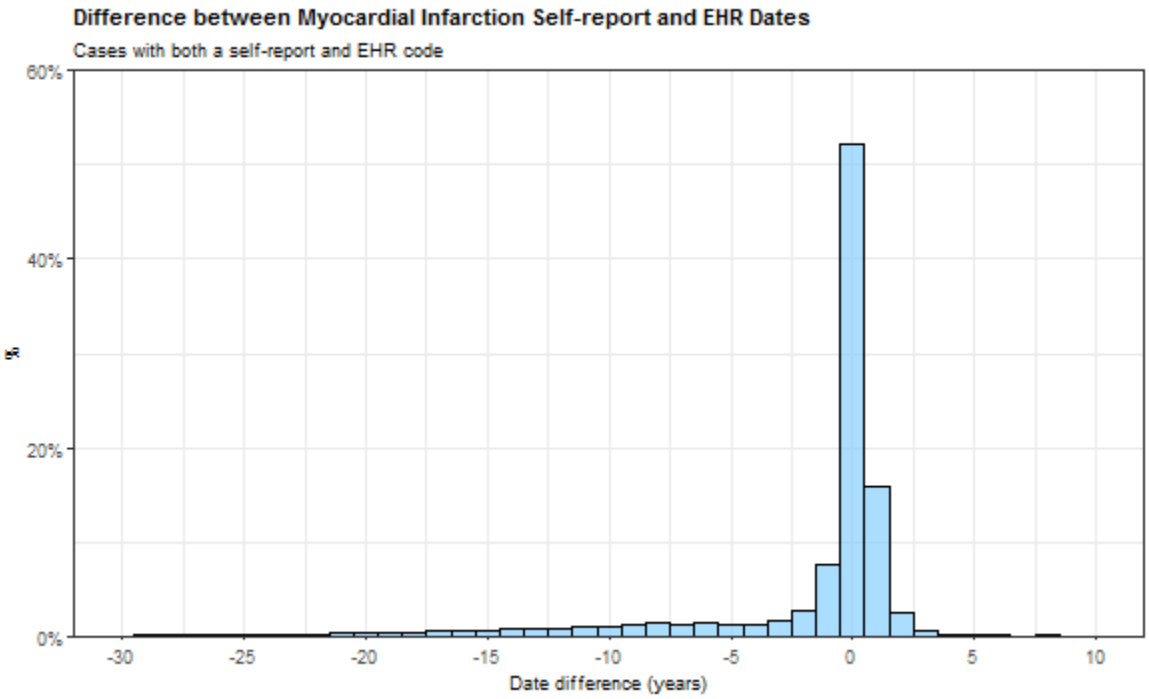
The PPV of MI events prior to recruitment identified by self-report alone is uncertain but likely to be lower than events confirmed in EHR.

Further direct validation studies in UK Biobank participants are ongoing and additional information on accuracy of event identification will be added to this documentation as it becomes available.

Appendix 2

The self-report date is taken from the UK Biobank field 20008 ("Interpolated Year when non-cancer illness first diagnosed"). At the nurse led interviews, nurses were instructed to record either a year or an age at which the diagnosis occurred. Where an age was provided, a best-fit fractional year was then calculated.

For cases that have both a self-report and EHR code, this algorithm assigns the EHR code date as the event date for the case. The histogram below shows the difference (in years) between self-report and EHR dates for the subset of MI cases that have both. Negative values indicate that the self-report date is earlier than the EHR. There is a good level of agreement between the dates from the two sources, with 68% of cases having a self-report date within 1 year of the EHR date.



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