Million Hearts® Outpatient Cardiac Rehabilitation Use Surveillance Methodology (February 2023)

Assessing Cardiac Rehabilitation Participation, Time to Initiation, Adherence, and Completion

Developed by: Million Hearts® Cardiac Rehabilitation Collaborative Surveillance Workgroup members

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Purpose: Provide an administrative claims-based outpatient cardiac rehabilitation (CR) surveillance methodology that can be applied to member databases within health insurance plans and health system databases to monitor and inform CR-related quality improvement efforts.

1. Measurement period for CR surveillance

- More than two years (27 months) of data are required to adequately report on most CR measures (Table 1).
    - This includes a ≥90-day lookback period prior to the qualifying event (QE) index date to accommodate the exclusion criteria (details below).
    - A 90-day lookback period is sufficient; however, a further lookback period may be used to ensure a cleaner population (e.g., no prior QEs) but at the tradeoff of reducing sample size or excluding certain populations (i.e., those without continuous enrollment).
- Identify CR-eligible members in year 1 and assess CR measures from year 1 to year 2.

2. Eligible population for CR

- Based on two Medicare decision memos, CAG-00089R and CAG-00437N, individuals are eligible for the CR benefit if they experienced ≥1 QE.[1,2]
- CR QEs using administrative claims-based data are identified using International Classification of Diseases, 9th/10th edition, Clinical Modification (ICD-9/-10-CM) diagnosis/procedural codes in an inpatient claim or Current Procedural Terminology (CPT) code in an outpatient or provider claim (Table 2).

2.1. Primary QEs (main CR surveillance)

1. Acute myocardial infarction (AMI)
2. Coronary artery bypass graft (CABG) surgery
3. Heart valve repair or replacement procedure
4. Percutaneous coronary intervention (PCI; includes percutaneous transluminal coronary angioplasty [PTCA] or coronary stenting and same-day discharge after an outpatient PCI)
5. Heart or heart-lung transplant
6. Single event: A primary QE in year 1 and no other primary QE within 21 days of the initial primary QE
7. Combination event: A primary QE in year 1 and another primary QE within 21 days of the initial primary QE, including events that occurred on the same day (e.g., AMI with PCI). Combination events should be treated separately from single events.[3]

2.2. Secondary QEs (secondary CR surveillance)

1. Current, stable angina pectoris
2. Stable, chronic heart failure (HF)

2.3. CR surveillance considerations

- For any CR QE that includes an AMI (e.g., AMI with CABG, AMI with HF, AMI with PCI, AMI alone), individuals have 365 days to start CR to have it covered by insurance.
- For all other CR QEs, there is no time window for starting CR and having it covered by insurance; however, in this algorithm, we adhere to the 365 days to start CR because it is clinically relevant and consistent with other reporting.
- According to CMS, standard outpatient CR sessions are limited to a maximum of two one-hour sessions per day, up to 36 sessions, over a period of up to 36 weeks, that do not need to be consecutive.[2]
- There is an option for an additional 36 sessions over an extended period of time if approved by Medicare (under section 1862(a)(1)(A) of the Social Security Act).[2]

2.4. Inclusion criteria

1. Alive for >21 days after the QE and
2. Continuous enrollment in a health plan or coverage in a health system for ≥90 days before and ≥365 days after the initial QE, or continuous enrollment until date of death if the individual died between 21 days and 365 days after the initial QE.

2.5. Exclusion criteria

1. Individuals with ≥90 consecutive days in an inpatient acute care hospital (inpatient prospective payment system reimbursed hospital, critical access hospital), other inpatient hospital (inpatient psychiatric facility, other hospital type [e.g., cancer center]), or post-acute care setting (long-term care hospital, inpatient rehabilitation facility, skilled nursing facility, home health):
    a. in the ≥90-day lookback period prior to the QE, or
    b. within 21 days after the initial QE (i.e., if the ≥90 consecutive days occurs within 21 days of the QE, then the patient is excluded)
2. Received hospice care
    a. in the ≥90-day lookback period prior to the QE, or
    b. within 21 days after the initial QE
3. Identified as having end-stage renal disease (ESRD) in the measurement period (see Appendix Table 1 for example value set).
    a. CR participation among individuals with ESRD could be tracked separately, as having the condition does not disqualify individuals from participating in CR.

3. QE index date

- The QE index date is the date CR surveillance begins and depends on the event type.

3.1. Primary QEs

- Single events (Appendix Figure 1)
    - The QE index date is the inpatient hospital discharge date associated with the QE or the outpatient procedure date.
- Combination events (Appendix Figure 1)
    - The QE index date is the inpatient hospital discharge date associated with the subsequent QE or the subsequent outpatient procedure date.

3.2. Secondary QEs

- Stable angina pectoris (need to identify 2 outpatient angina claims; Appendix Figure 1):
    - The QE index date is the date associated with the first outpatient angina claim identified in the measurement period
- Stable, chronic HF: outpatient visit methodology (need to identify 2 outpatient HF claims; Appendix Figure 2)

  - If a CVD hospitalization occurred 6 weeks prior to the first outpatient HF claim, then the QE index date is identified through an iterative process of looking forward 6 weeks for a CVD hospitalization
  - If a CVD hospitalization did not occur 6 weeks prior to the first outpatient HF claim, then the QE index date is the date associated with the first outpatient HF claim
- Stable, chronic HF: inpatient and procedure-based methodology (Appendix Figure 3)
  - If a CVD hospitalization occurred 6 weeks after the first HF-related inpatient hospitalization or procedure, then the QE index date is identified through an iterative process of looking forward 6 weeks after discharge from the most recent CVD hospitalization for another CVD hospitalization
  - If a CVD hospitalization did not occur 6 weeks after the first HF-related inpatient hospitalization or procedure, then the QE index date is the date associated with the first CR service claim after the HF-related inpatient hospitalization or the date six weeks from the HF-related inpatient hospitalization discharge date, whichever occurred first

4. Identifying CR claims

4.1. Codes to identify CR claims

- Standard and intensive CR participation can be tracked separately or together.
- A CR session is defined as having one of the following Healthcare Common Procedure Coding System (HCPCS) codes when billed with line place of service code 11 (services provided in a physician's office), 19 (off campus-outpatient hospital), or 22 (on campus-outpatient hospital).
- Standard CR
  - 93797: Physician services for outpatient CR; without continuous electrocardiographic (ECG) monitoring
  - 93798: Physician services for outpatient CR; with continuous ECG monitoring
- Intensive CR
  - G0422: Intensive CR; With or Without continuous ECG monitoring, With Exercise
  - G0423: Intensive CR; With or Without continuous ECG monitoring, Without Exercise
- Revenue center code 0943 may also be used to identify additional CR claims:
  - For example, in the CMS data, the revenue codes are not in the Part B non-institutional/carrier claims, but they are in the Part B institutional/hospital outpatient claims and could be used in conjunction with HCPCS codes to identify CR (i.e., if HCPCS in [93797, 93798, G0422, G0423] or revenue center code in [0943]). However, most CR encounters are identified in the Part B non-institutional/carrier claims using the 4 HCPCS codes.

4.2. Counting CR claims

- If the dataset contains units of services provided, account for the number of CR units when counting number of CR sessions. For instance, one CR claim could have 2 units, which is due to 2 CR sessions being billed jointly. Simply counting the number of individual CR claims could result in an undercount of the number of sessions completed.
- If the dataset does not contain units of service provided (or the units are unrelated to the CR encounter), count the number of individual CR claims on different dates to identify number of CR sessions. If ≥1 CR service claim is identified on the same day, count the claims as a single session.

5. CR surveillance measures

- Definitions for CR measures have been updated from CR surveillance use methodology v2.1 to include options for aligning analyses with CR clinical quality measure specifications from the American College of Cardiology (ACC), American Heart Association (AHA), and National Committee for Quality Assurance (NCQA) and/or for standardizing the reporting of outcomes (Table 1).

6. Main CR use surveillance methodology

- Use the ICD-9/-10-CM diagnosis and procedure codes and CPT/HCPCS codes to identify the primary QEs (Table 2).
- Follow the main CR use surveillance methodology to report on the CR measures for primary QEs (Appendix Figure 1).
- An example table shell for main CR surveillance is provided (Table 3).

6.1. Steps for main CR use surveillance; Appendix Figure 1

- Step 1: During year 1 of the measurement period, determine the number of individuals who had a CR QE.
- Step 2: Identify the CR QE index date (beginning of CR surveillance)
    - Step 2a: If the individual had a single event, then the CR QE index date is the inpatient hospital discharge date associated with the QE or the outpatient procedure date.
    - Step 2b: If the individual had a combination event, then the CR QE index date is the inpatient hospital discharge date associated with the subsequent QE or the subsequent outpatient procedure date.
    - Step 2c: If a direct inpatient transfer occurred (i.e., a patient transferred from one inpatient facility to another with discharge and admission dates occurring on the same day or one day apart), then the CR QE index date is the discharge date from the second inpatient facility.
- Step 3: From the CR QE index date, look forward 365 days and identify the first CR service claim.
- Step 4: From the first CR service claim, look forward 36 weeks (8 months) to count number of CR sessions attended.

7. Secondary CR use surveillance methodology

- Individuals eligible for CR based on the conditions included in the main surveillance should be excluded from the secondary CR surveillance.
- Secondary QEs can be analyzed as:
    - Mutually exclusive categories: if an individual has current, stable angina pectoris and stable, chronic HF, assign them to the event with the earliest CR QE index date and track for use of CR services; or
    - Non-mutually exclusive categories: if an individual has current, stable angina pectoris and stable, chronic HF, assign them to both QEs and track for use of CR services.
- An example table shell for secondary CR surveillance is provided (Table 3)

7.1. Current, stable angina pectoris

- Use the ICD-9/-10-CM diagnosis codes to identify stable angina pectoris (Table 2).
- Follow the main CR use surveillance methodology to report on the CR measures for current, stable angina pectoris (Appendix Figure 1).

7.2.1. Stable, chronic HF

- Use the ICD-9/-10-CM diagnosis and procedure codes and CPT codes to identify stable, chronic HF (Table 2).
- In year 1 of the measurement period,
    - if the individual first had ≥2 outpatient HF claims in the outpatient setting, follow the stable, chronic HF CR use surveillance outpatient visit methodology (Appendix Figure 2).
    - if the individual had (1) ≥1 HF claim first in the inpatient setting, (2) a HF-related hospitalization after the first but before the second outpatient HF claim (Appendix Figure 2), or (3) a HF-related procedure, follow the stable, chronic HF CR use surveillance inpatient and procedure-based methodology (Appendix Figure 3).

7.2.2. Steps for CR use surveillance for stable, chronic HF (outpatient visit methodology; Appendix Figure 2)

- Step 1: During year 1 of the measurement period, identify the two outpatient diagnosis-based HF claims (Table 2) occurring on separate dates without a CVD hospitalization occurring between the two claims (see Appendix Table 1 for how to identify CVD-related claims[4]). If a CVD hospitalization occurred between the two outpatient claims, follow the methodology described in Appendix Figure 3.
- Step 2: Look back 6 weeks from the date of the first outpatient HF claim for a CVD hospitalization.
- Step 3a: If a CVD hospitalization occurred in Step 2 (CVD hospitalization 1), identify the HF QE index date (beginning of CR surveillance) through an iterative process of looking forward 6 weeks from CVD hospitalization 1 for another CVD hospitalization.
    - Step 3a1: If a CVD hospitalization occurred (CVD hospitalization 1) and no other CVD hospitalization occurred 6 weeks after discharge from CVD hospitalization 1, then the HF QE index date is the date of the first CR service claim or the date six weeks after discharge from CVD hospitalization 1, whichever occurred first.
    - Step 3a2: If a CVD hospitalization occurred and another CVD hospitalization occurred 6 weeks after discharge from CVD hospitalization 1 (CVD hospitalization 2), then the HF QE index date is the date of the first CR service claim after CVD hospitalization 2 or the date six weeks after discharge from CVD hospitalization 2, whichever occurred first.
    - Step 3a3: Repeat the process of looking forward 6 weeks after discharge from the most recent CVD hospitalization for another CVD hospitalization, until there exists a 6-week window without a CVD hospitalization or CR is initiated, whichever occurred first.
    - Step 3a4: If year 1 ends without establishing the HF QE index date in order to begin CR surveillance, then the final 6-week assessment for a CVD hospitalization should continue into year 2, but no additional 6-week window assessments should be performed in year 2. If CR surveillance cannot be performed because the individual had another CVD hospitalization during the final 6-week assessment that continued into year 2, remove the individual from the CR-eligible cohort.
- Step 3b: If a CVD hospitalization did not occur in Step 2, then the HF QE index date (beginning of CR surveillance) is the date of the first outpatient HF claim.
- Step 4: From the HF event index date, look forward 36 weeks (8 months) to count number of CR sessions attended.

7.2.3. Steps for CR use surveillance for stable, chronic HF (inpatient and procedure-based methodology; Appendix Figure 3)

- Step 1: During year 1 of the measurement period, identify the first HF-related inpatient hospitalization or procedure.
- Step 2: Look forward 6 weeks from the date of the first HF-related inpatient hospitalization or procedure for a CVD hospitalization (see Appendix Table 1 for how to identify CVD-related claims[4])
- Step 3a: If a CVD hospitalization occurred in Step 2 (CVD hospitalization 1), identify the HF QE index date (beginning of CR surveillance) through an iterative process of looking forward 6 weeks after discharge from the most recent CVD hospitalization for another CVD hospitalization.
    - Step 3a1: If a CVD hospitalization occurred (CVD hospitalization 1) and no other CVD hospitalization occurred within 6 weeks of discharge from CVD hospitalization 1, then the HF QE index date is the date of the first CR service claim or the date associated with 6 weeks after discharge from the CVD hospitalization, whichever occurred first.
    - Step 3a2: If a CVD hospitalization occurred and another CVD hospitalization occurred within 6 weeks of discharge from CVD hospitalization 1 (CVD hospitalization 2), then the HF QE index date is the date of the first CR service claim after CVD hospitalization 2 or the date associated with 6 weeks after discharge from CVD hospitalization 2, whichever occurred first.
    - Step 3a3: Repeat the process of looking forward 6 weeks after discharge from the most recent CVD hospitalization for another CVD hospitalization, until there exists a 6-week

window without a CVD hospitalization or a CR service claim was identified, whichever occurred first.
    - Step 3a4: If year 1 ends without establishing the HF QE index date to begin CR surveillance, then the final 6-week assessment for a CVD hospitalization should continue into year 2, but no additional 6-week window assessments should be performed in year 2. If CR surveillance cannot be performed because the individual had another CVD hospitalization during the final 6-week assessment that continued into year 2, remove the individual from the CR-eligible cohort.
- Step 3b: If a CVD hospitalization did not occur in Step 2, the HF QE index date (beginning of CR surveillance) is the date of the first CR service claim after the HF-related inpatient hospitalization or the date six weeks from the HF-related inpatient hospitalization discharge date, whichever occurred first.
- Step 4: From the HF QE index date, look forward 36 weeks (8 months) to count number of CR sessions attended.

7.2.4. Limitations of methodology for stable, chronic HF

- Unable to capture New York Heart Association (NYHA) class and formally determine preserved versus reduced left ventricular ejection fraction (LVEF) using administrative data. If the researcher has access to clinical data and NYHA classification information, these criteria can be applied to the definition for stable, chronic HF.
- Unable to know what hospitalizations or procedures were planned (versus unplanned) at the time the individual became eligible for CR. If the researcher has access to this type of information, these criteria can be applied to definition for stable, chronic HF.

8. Considerations for subgroup analyses

- Consider assessing CR measures by patient/demographic characteristics (age group, sex, race/ethnicity, initial QE type); combinations of demographic characteristics (e.g., race/ethnicity by age and/or sex); geographic classifications (e.g., hospital referral region, county, census block); and/or groups at increased risk for poor CR participation (e.g., patients with chronic kidney disease, certain demographic groups)

Table 1. Cardiac rehabilitation use surveillance measures

Measure		Definition
Eligibility	CDC	Number of individuals who had a CR QE out of all individuals identified in the measurement period
	Option	Express as the number of individuals with QEs per 1,000 individuals (acknowledging that rates will be population specific and steps could be taken to be made more standardized, e.g., age standardization)
Enrollment	CDC	Percentage of individuals who had a CR QE and attended ≥1 CR session within 365 days of the QE index date.
	Option	Individuals who enrolled in CR within the first 21 days after the QE aligns with the 2018 ACC/AHA clinical performance and quality measures for CR quality measure one (QM-1, CR Time to Enrollment).[5]
Initiation	CDC	Percentage of individuals who attended ≥2 sessions of CR within 365 days of the CR QE index date.
	Option	Individuals who attended ≥2 sessions of CR within 30 days after a QE aligns with the 2021 NCQA new HEDIS CR measure.[6]
Time to CR Initiation	CDC	Time (in days) from the QE index date to the *second* CR session date.
Adherence	CDC	Mean number of CR sessions attended within 36 weeks of initiating CR.
Participation 1/ Engagement 1	CDC	Percentage of individuals who attended ≥12 sessions of CR within 36 weeks of enrollment (i.e., Participation 1).
	Option	Individuals who attended ≥12 sessions of CR within 90 days after a QE aligns with the 2021 NCQA new HEDIS CR measure (i.e., Engagement 1).[6]
Participation 2/ Engagement 2	CDC	Percentage of individuals who attended ≥24 sessions of CR within 36 weeks of enrollment (i.e., Participation 2).
	Option	Individuals who attended ≥24 sessions of CR within 180 days after a QE aligns with the 2021 NCQA new HEDIS CR measure (i.e., Engagement 2).[6]
Participation 3/Completion/ Achievement	CDC	Percentage of individuals who attended ≥36 sessions of CR within 36 weeks of enrollment (i.e., Participation 3/Completion).
	Option	Individuals who attended ≥36 sessions of CR within 180 days after a QE aligns with the 2021 NCQA new HEDIS CR measure (i.e., Achievement).[6]

Abbreviations: American College of Cardiology (ACC); American Heart Association (AHA); CR, cardiac rehabilitation; HEDIS, Healthcare Effectiveness Data and Information Set; NCQA, National Committee for Quality Assurance; QE, qualifying event; QM, quality measure

Table 2. Diagnosis and procedural codes used to identify cardiac rehabilitation QEs[a]

Main Surveillance		
AMI[b]		
ICD-9-CM DX	**ICD-10-CM DX**	
410.00, 410.01, 410.02, 410.10, 410.11, 410.12, 410.20, 410.21, 410.22, 410.30, 410.31, 410.32, 410.40, 410.41, 410.42, 410.50, 410.51, 410.52, 410.60, 410.61, 410.62, 410.70, 410.71, 410.72, 410.80, 410.81, 410.82, 410.90, 410.91, 410.92	I21.0, I21.01, I21.02, I21.09, I21.1, I21.11, I21.19, I21.2, I21.21, I21.29, I21.3, I21.4, I21.9, I21.A1, I21.A9, I22.0, I22.1, I22.2, I22.8, I22.9	
CABG surgery (inpatient procedure)		
ICD-9-CM PR	**ICD-10-PCS**	**CPT/HCPCS**
36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.17, 36.19, 36.2	0210[c], 0211[c], 0212[c], 0213[c], 02700[d], 02710[d], 02720[d], 02730[d], 02C00[d], 02C10[d], 02C20[d], 02C30[d]	33510, 33511, 33512, 33513, 33514, 33516, 33533, 33534, 33535, 33536, S2205, S2206, S2207, S2208, S2209
Heart valve repair/replacement procedures (inpatient procedure)		
ICD-9-CM PR	**ICD-10-PCS[c]**	**CPT**
35.00, 35.01, 35.02, 35.04, 35.05, 35.06, 35.07, 35.08, 35.09, 35.10, 35.11, 35.12, 35.13, 35.14, 35.20, 35.21, 35.22, 35.23, 35.24, 35.25, 35.26, 35.27, 35.28, 35.33, 35.96, 35.97, 35.99	027F, 027G, 027H, 027J, 02CF, 02CG, 02CH, 02CJ, 02NF, 02NG, 02NH, 02NJ, 02QF, 02QG, 02QH, 02QJ, 02RF, 02RG, 02RH, 02RJ, 02TH, 02UF, 02UG, 02UH, 02UJ, 02VG	33361-33366; 33390-33391; 33400-33401; 33403-33406; 33410-33418; 33420; 33422; 33425-33427; 33430; 33460; 33463-33465; 33468; 33470-33472; 33474-33478; 33863; 0345T; 0483T; 0544T; 0545T; 0569T
PCI (inpatient/outpatient procedure)[e]		
ICD-9-CM PR	**ICD-10-PCS[c]**	**CPT**
00.66, 36.03, 36.04, 36.06, 36.07, 36.09	02703[d], 02704[d], 02713[d], 02714[d], 02723[d], 02724[d], 02733[d], 02734[d], 02C03[d], 02C04[d], 02C13[d], 02C14[d], 02C23[d], 02C24[d], 02C33[d], 02C34[d], 3E07017, 3E070PZ, 3E07317, 3E073PZ	92920, 92924, 92928, 92933, 92937, 92941, 92943, 92975
Heart or heart-lung transplant or VAD (inpatient procedure)		
ICD-9-CM PR	**ICD-10-PCS**	**CPT**
33.6, 37.51, 37.52, 37.53, 37.54,	02YA0Z0, 02YA0Z1, 02YA0Z2, 02RK0JZ, 02RL0JZ, 02WA0JZ	33927, 33928, 33945, 0051T, 0052T, 0053T
Secondary Surveillance		
Current stable[f] angina pectoris[g]		
ICD-9-CM DX	**ICD-10-CM DX**	
413.0, 413.1, 413.9	I20.1, I20.8, I20.9	
Stable[f] chronic heart failure[h] (diagnosis based[i])		
ICD-9-CM DX	**ICD-10-CM DX**	
428.22, 428.42	I50.22, I50.42, I50.82	

Stable[f] chronic heart failure[h] (procedure based[i])		
Implantable (intracorporeal) ventricular assist device insertion/replacement		
ICD-9-CM PR	**ICD-10-PCS**	**CPT**
37.66	02HA0QZ	33979
Bi-ventricular pacemaker insertion		
ICD-9-CM PR	**ICD-10-PCS**	**CPT**
00.50, 00.51, 00.53, 00.54	0JH609Z, 0JH639Z, 0JH809Z, 0JH839Z, 0JH607Z, 0JH637Z, 0JH807Z, 0JH837Z	33224, 33225

Abbreviations: AMI, acute myocardial infarction; CABG, coronary artery bypass graft; CPT, Current Procedural Terminology; DX, diagnosis; HCPCS, Healthcare Common procedure Coding System; ICD-9/-10-CM, International Classification of Diseases, 9th/10th edition, Clinical Modification; PCI, percutaneous coronary intervention; PCS, procedure coding system; PR, procedural; VAD, ventricular assist device; QE, qualifying event

[a] ICD-9-CM codes are in effect until September 30, 2015, and ICD-10-CM codes are in effect starting on October 1, 2015. Effective dates for ICD-9-CM, ICD-10-CM, and CPT codes may vary by year.
[b] Code first or second listed ICD-9/-10-CM diagnosis code
[c] Includes all codes with these as the first four identifiers
[d] Includes all codes with these as the first five identifiers
[e] PCI includes percutaneous transluminal coronary angioplasty [PTCA] or coronary stenting and same-day discharge after an outpatient PCI
[f] A stable condition is defined as no recent (≤6 weeks) or planned (≤6 months) major cardiovascular hospitalizations or procedures according to the Centers for Medicare and Medicaid Services.[2]
[g] ICD-9/-10-CM in any location on ≥2 outpatient claims in year 1 of the measurement period[3]
[h] Chronic heart failure is defined as having a left ventricular ejection fraction (LVEF) ≤35% and New York Heart Association (NYHA) class II to IV, effective for claims on or after February 18, 2014 for Medicare Fee-for-service beneficiaries.[2] The effective date will need to be determined for individuals on other health plans.
[i] ICD-9/-10-CM in any location

Table 3. Cardiac rehabilitation surveillance table shell

	Total	**Eligible**		**Enrollment[a]**		**Initiation[b]**		**Engagement 1[c]**		**Engagement 2[d]**		**Achievement 3[e]**	
	N	N	Rate[f]	N	%[g]	N	%[g]	N	%[h]	N	%[h]	N	%[h]
Overall													
Age groups (years)													
18-44													
45-54													
55-64													
65-74													
75-84													
85+													
Sex													
Male													
Female													
Race/ethnicity													
Non-Hispanic White													
Non-Hispanic Black													
Hispanic													
Asian													
Other race/ethnicity													
Unknown													
Primary QE type													
AMI													
With no procedure													
With any procedure													
CABG													
With AMI													
No AMI													
PCI													
With AMI													
No AMI													
Heart valve procedure													
With AMI													
No AMI													
Heart or heart-lung transplant													

Combination procedure													
With AMI													
No AMI													
CABG + heart valve[i]													
Secondary QE type[j]													
Stable angina													
Heart failure, overall													
Diagnosis based													
Procedure based													
VAD insertion													
BiV pacer insertion													

Abbreviations: AMI, acute myocardial infarction; BiV pacer, bi-ventricular pacemaker; CR, cardiac rehabilitation; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention; VAD, (implantable) ventricular assist device

[a] ≥1 CR session overall and within 21 days
[b] ≥2 CR sessions overall and within 30 days
[c] ≥12 CR sessions overall and within 90 days
[d] ≥24 CR sessions overall and within 180 days
[e] ≥36 sessions overall and within 180 days
[f] Rate per 1,000
[g] Percent among eligible
[h] Percent among among eligible or initiators
[i] Both a CABG and heart valve procedure were performed with the first 21 days of the initial QE with or without an AMI occurring; no other procedures were performed during that period.
[j] Excludes members who were eligible for CR based on conditions and events captured in the main CR surveillance

Appendix

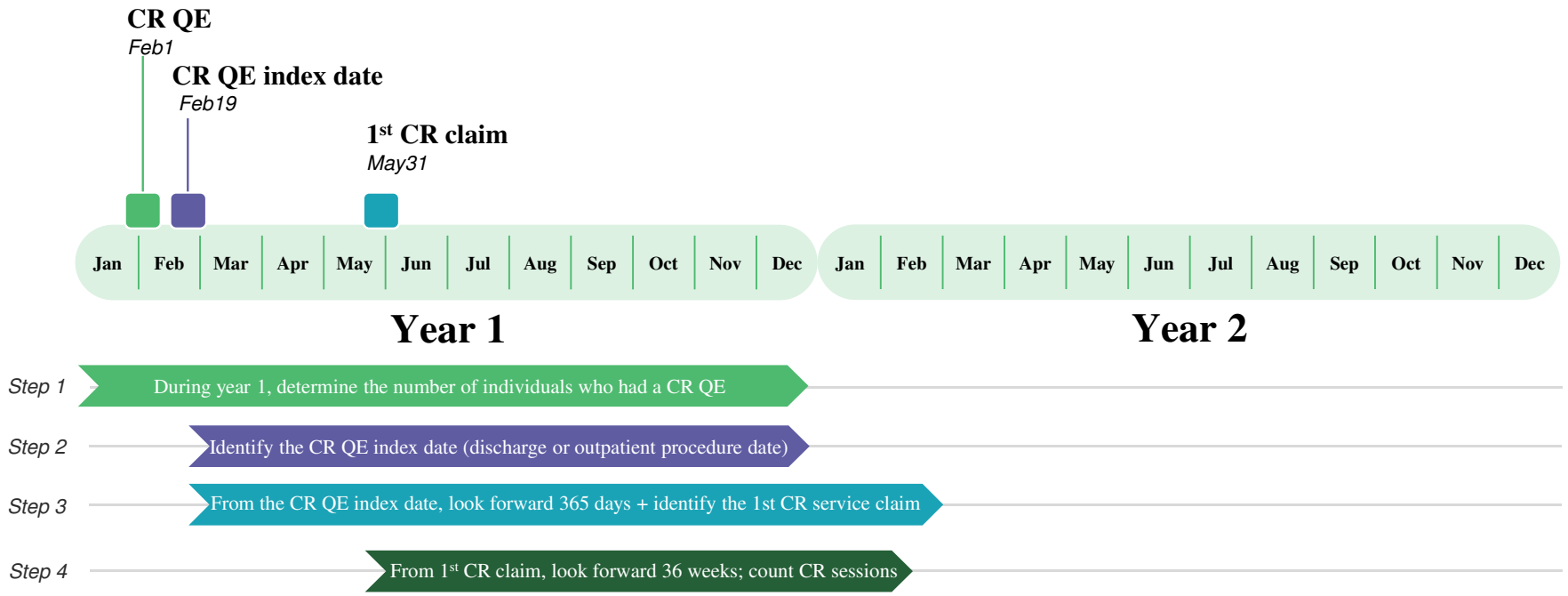
Appendix Table 1. Example value sets

ESRD[a]	
ICD-9-CM DX	**ICD-10-CM DX**
585.5, 585.6, V42.0, V45.1, V56	N18.5, N18.6, Z49, Z91.15, Z94.0, Z99.2
CVD-related claims[b]	
ICD-9-CM DX	**ICD-10-CM DX**
390-434, 436-448	I00-I78

Abbreviations: CPT, Current Procedural Terminology; CVD, cardiovascular disease; ESRD, end stage renal disease; DX, diagnosis; HCPCS, Healthcare Common procedure Coding System; ICD-9/-10-CM, International Classification of Diseases, 9th/10th edition, Clinical Modification

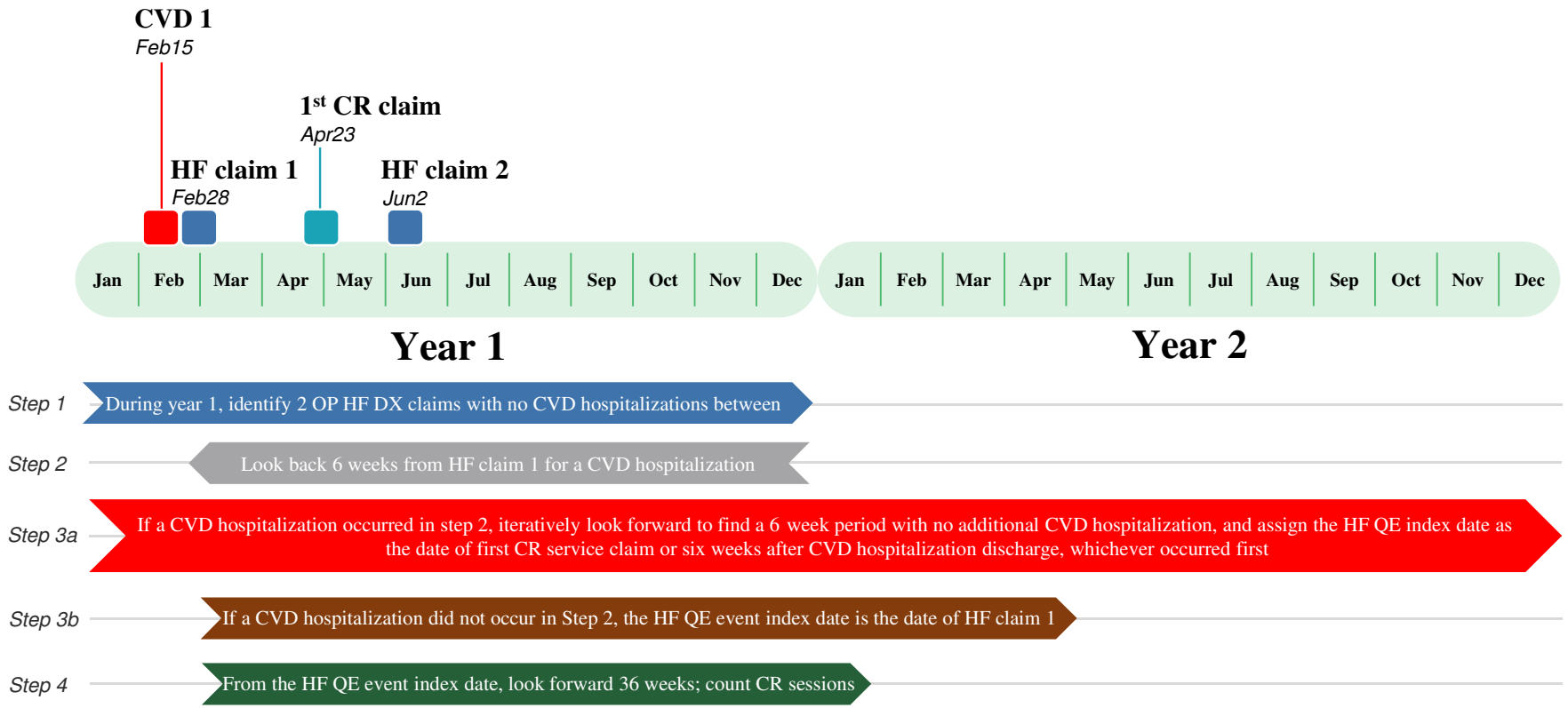
[a] Excludes people with Stage 5 chronic kidney disease or end stage renal disease
[b] Use the first- or second-listed ICD-9/-10-CM diagnosis codes

Appendix Figure 1. Main CR use surveillance



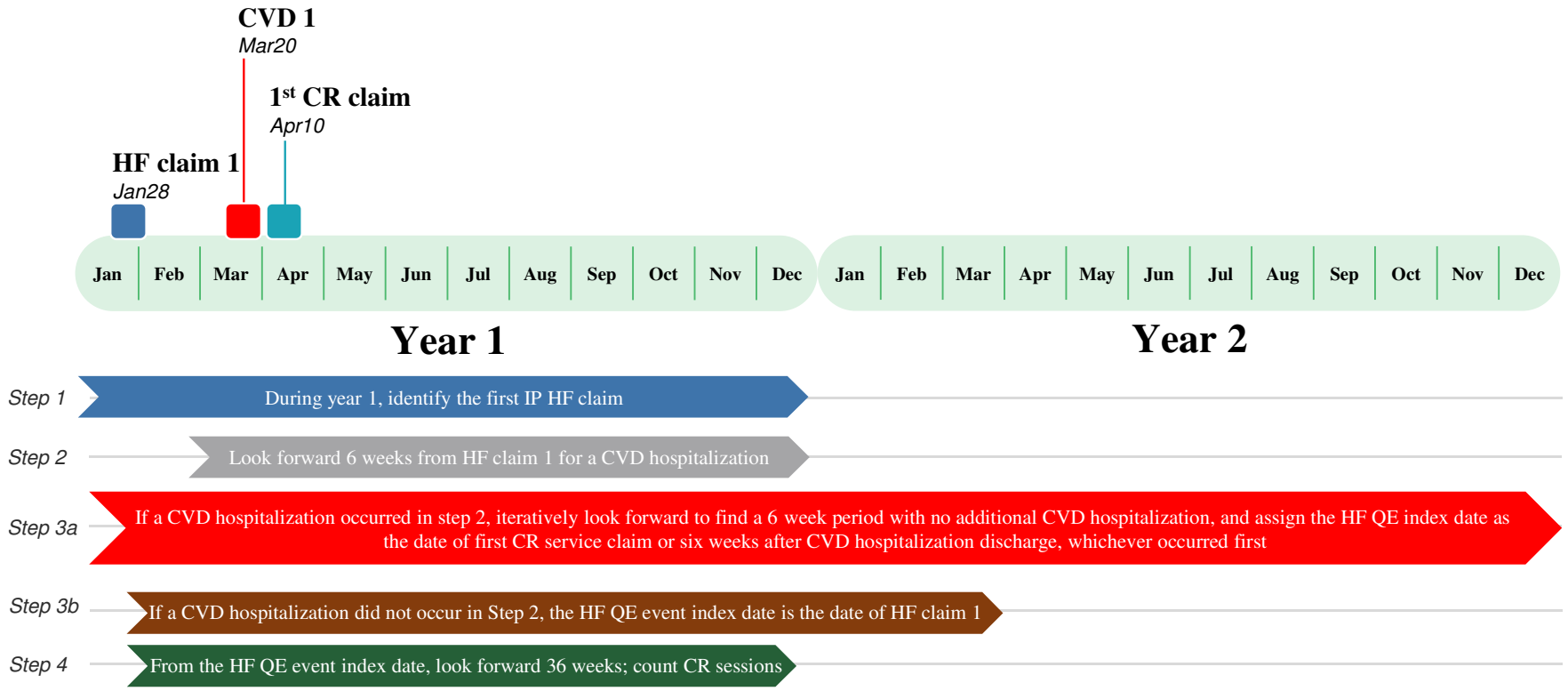
Abbreviations: CR, cardiac rehabilitation; QE, qualifying event

Appendix Figure 2. Stable, chronic HF CR use surveillance: outpatient visit methodology



Abbreviations: CR, cardiac rehabilitation; CVD, cardiovascular disease; DX, diagnosis; HF, heart failure; QE, qualifying event; OP, outpatient

Appendix Figure 3. Stable, chronic HF CR use surveillance: inpatient and procedure-based methodology



Abbreviations: CR, cardiac rehabilitation; CVD, cardiovascular disease; HF, heart failure; IP, inpatient; QE, qualifying event

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