FUNDAMENTALS OF eCQM DEVELOPMENT

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Development Fundamentals:

1. CMS Measures Management System Blueprint, V11.1

2. Quality Data Model

3. Developing an eMeasure
- Value Set Authoring Center
- Measure Authoring Tool
- Bonnie Testing Tool

What is an eCQM?

Electronic clinical quality measures (eCQMs) are standardized performance measures derived solely for use in EHRs.

…To reduce the burden of collecting and reporting data by automating process

…To promote greater consistency in measure development, uniformity in clinical concept definitions, and comparability of performance results through *standardization*.

eMeasures require a few additional steps when creating:

- encoded in XML to be rendered as human readable

- conforms to the HQMF HL7 standards

- specifies patient-level data for EHR extraction

- maps to QDM components and vocabularies

XML: extensible markup language

HQMF: Health Quality Measure Format

HL7: Health Level 7

QDM: Quality Data Model

Chart Abstraction Process:

- RECORD
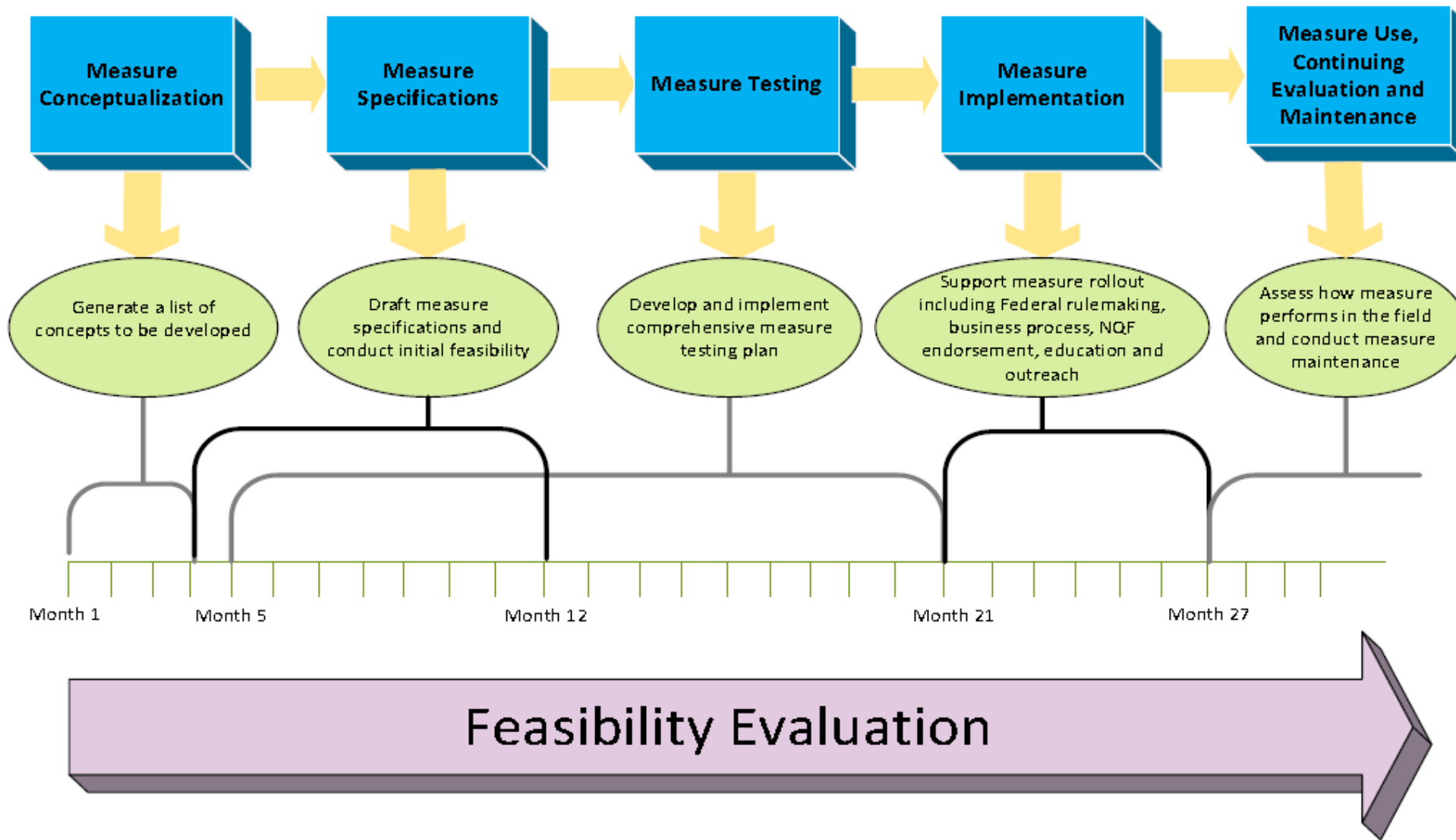- INTERPRET
- CALCULATE

vs.

eCQM Process:

- RECORD
- CALCULATE

eMeasure Lifecycle

Stakeholders

- Healthcare providers
- EHR/Health IT vendors
- EHR implementers
- Medical Informaticists
- Programmers
- Coding Experts
- Measure developers
- Current EHR users
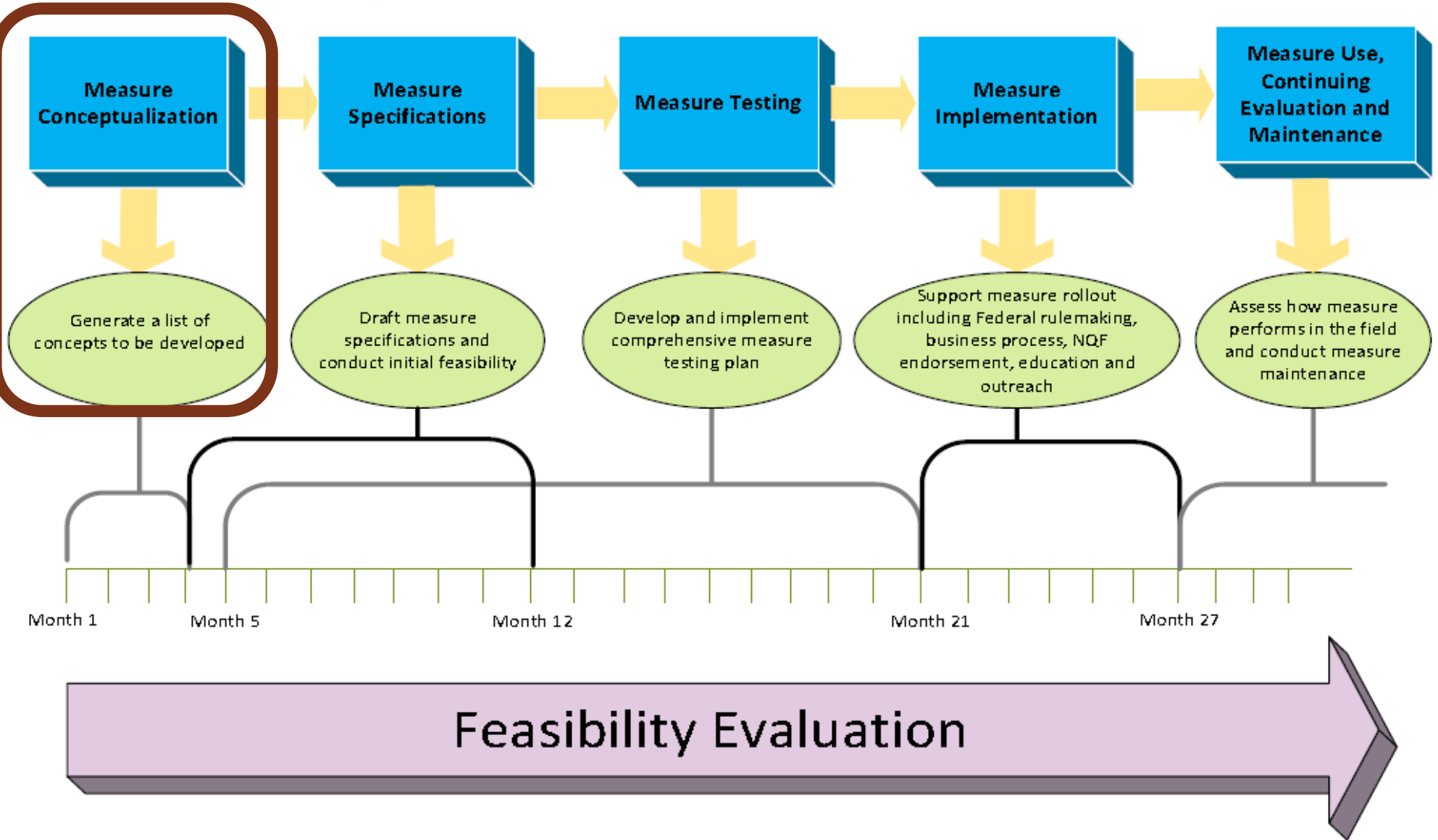- Technical Expert Panels (TEPs)
- Clinical Expert Panels

Tools and Resources

- Value Set Authority Center (VSAC)
- Measure Authoring Tool (MAT)
- Bonnie
- Quality Data Model (QDM)
- Health Quality Measures Format (HQMF) standard
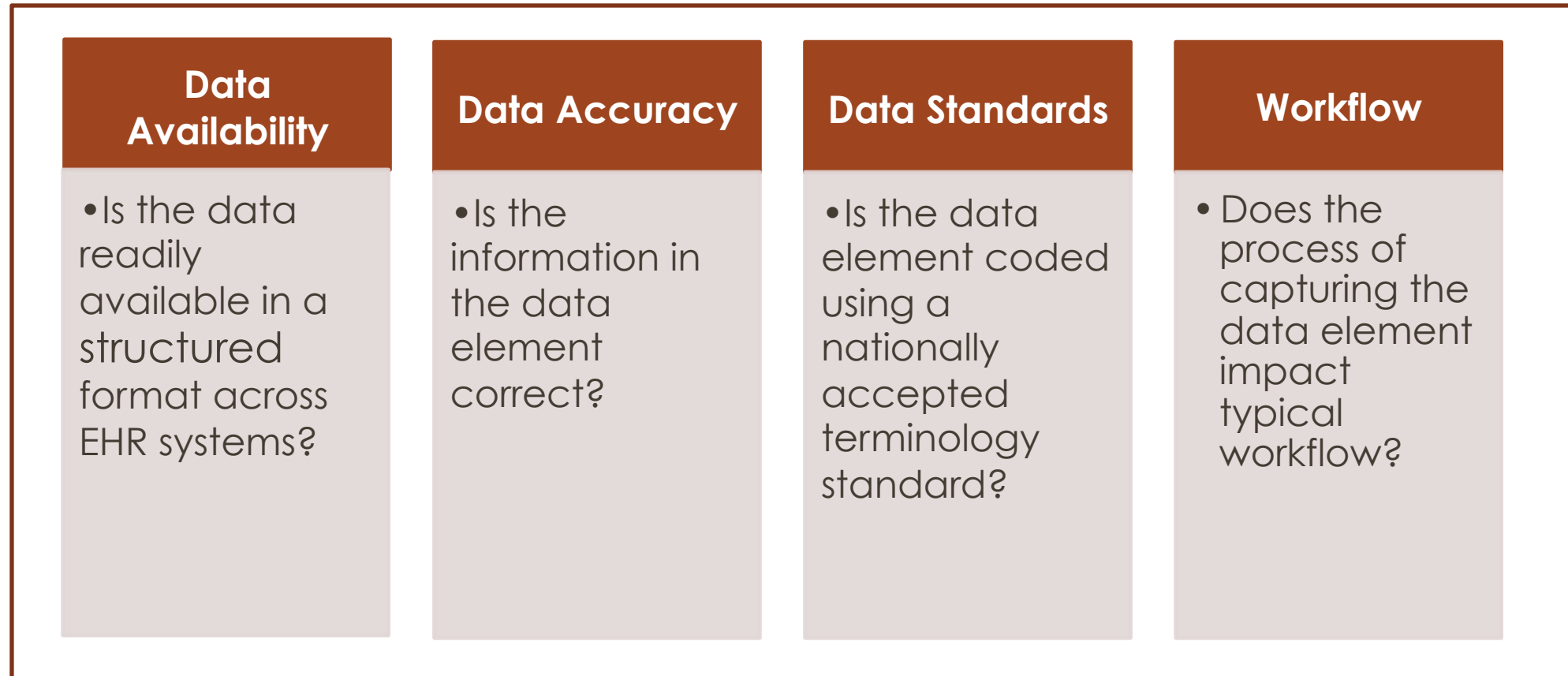- CMS Blueprint
- Quality Data Reporting Architecture (QRDA)

Data Availability	**Data Accuracy**	**Data Standards**	**Workflow**
• Is the data readily available in a structured format across EHR systems?	• Is the information in the data element correct?	• Is the data element coded using a nationally accepted terminology standard?	• Does the process of capturing the data element impact typical workflow?

NQF's eMeasure Feasibility Assessment 2013 http://www.qualityforum.org/Publications/2013/04/eMeasure_Feasibility_Assessment.aspx

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Identify feasibility concerns to determine next steps:

- Replace or revise data elements
- Stop further development
- Determine a plan for addressing the concerns
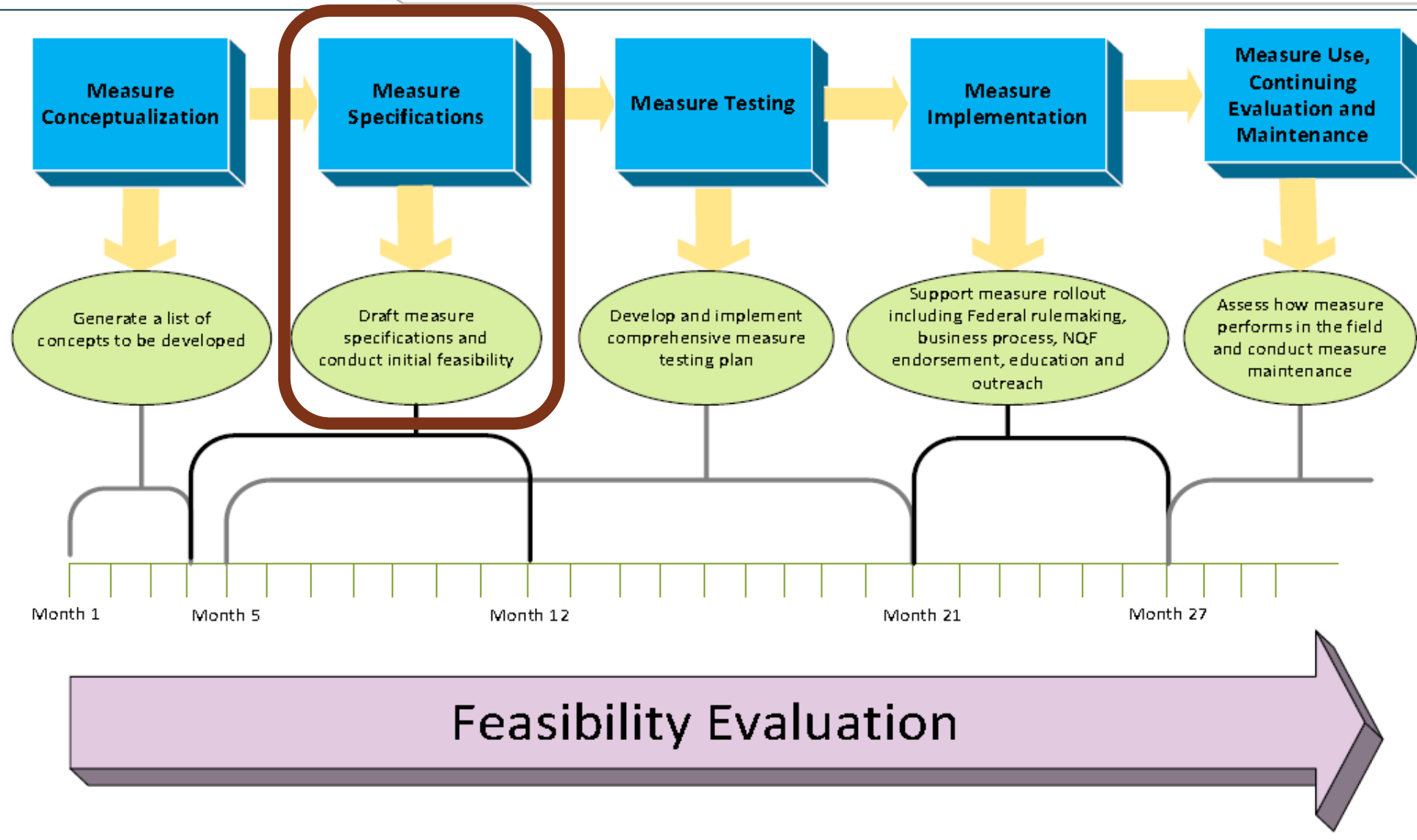
HQMF

- A standard structure for constructing an electronic quality measure

- HL7 standards

- Provides for quality measure consistency and unambiguous interpretation

- Defines a **header** for classification and management of the quality measures and metadata that describes the measure

- Contains a **body** that carries content of quality measure

eMeasure Title	Aspirin Prescribed at Discharge		
eMeasure Identifier (Measure Authoring Tool)	100	eMeasure Version number	3.2.007
NQF Number	0142	GUID	bb481284-30dd-4383-928c-82385bbf1b17
Measurement Period	January 1, 20XX through December 31, 20XX		
Measure Steward	Centers for Medicare & Medicaid Services (CMS)		
Measure Developer	Oklahoma Foundation for Medical Quality		
Endorsed By	National Quality Forum		
Description	Acute myocardial infarction (AMI) patients who are prescribed aspirin at hospital discharge		
Copyright	Measure specifications are in the Public Domain. LOINC (R) is a registered trademark of the Regenstrief Institute.		

Header

Population Criteria

- **Initial Population =**
  - AND: Age >= 18 year(s) at: Occurrence A of $EncounterInpatient
  - AND: Union of:
    - "Diagnosis, Active: Acute Myocardial Infarction (AMI) (ordinality: Principal)" starts during Occurrence A of $EncounterInpatient
    - "Diagnosis, Active: Acute Myocardial Infarction (AMI) (ordinality: Principal)" starts during ("Encounter, Performed: Emergency Department Visit" <= 1 hour(s) ends before or concurrent with start of Occurrence A of $EncounterInpatient)
- **Denominator =**
  - AND: Initial Population
- **Denominator Exclusions =**
  - OR: Intersection of:
    - Occurrence A of $EncounterInpatient
    - "Encounter, Performed: Encounter Inpatient" satisfies any
      - (discharge status: Discharge To Acute Care Facility)
      - (discharge status: Left Against Medical Advice)
      - (discharge status: Patient Expired)
      - (discharge status: Discharged to Home for Hospice Care)
      - (discharge status: Discharged to Health Care Facility for Hospice Care)
  - OR: $InterventionComfortMeasures starts during ("Encounter, Performed: Emergency Department Visit" <= 1 hour(s) ends before or concurrent with start of Occurrence A of $EncounterInpatient)
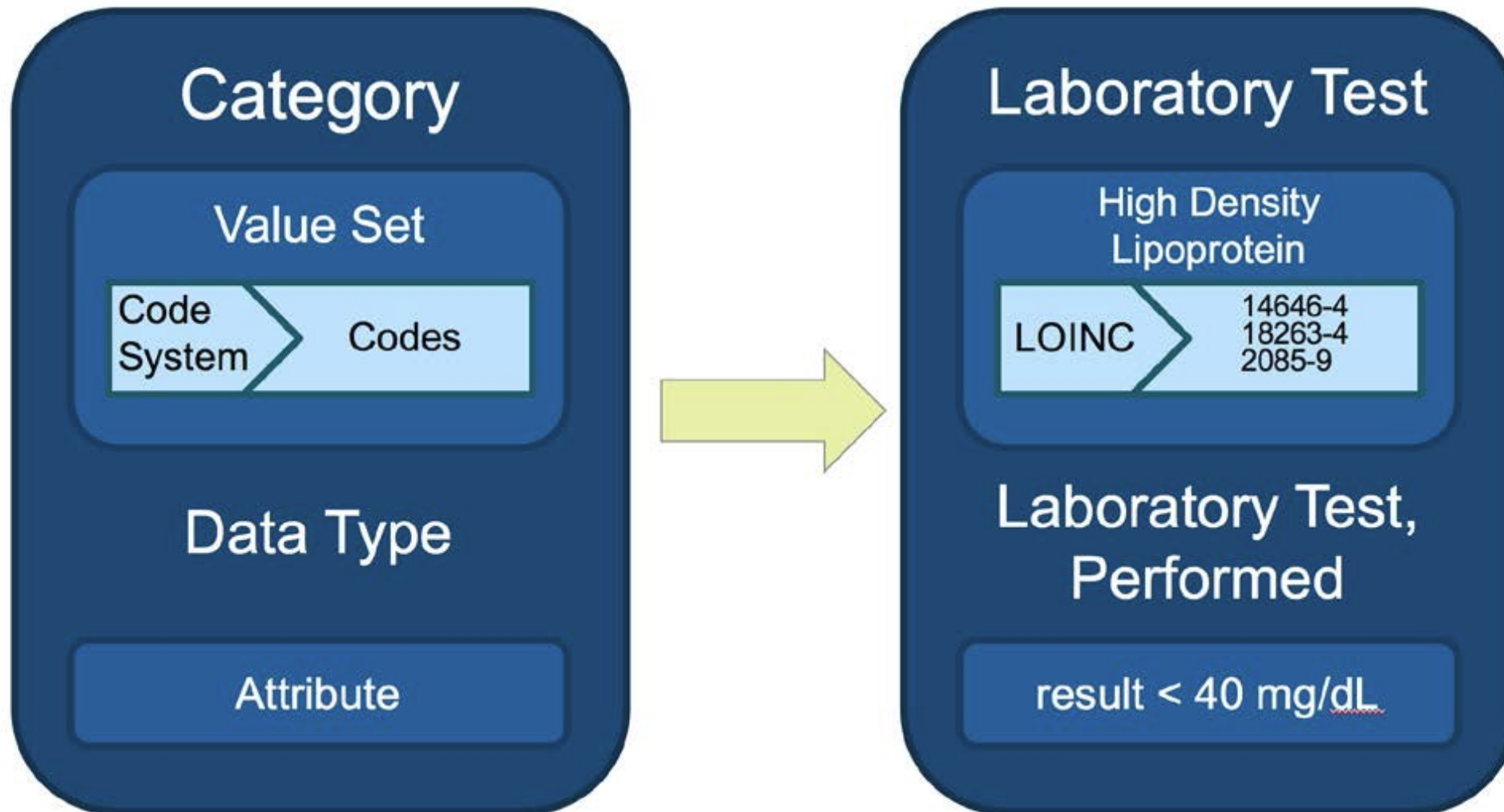 - OR: $InterventionComfortMeasures starts during Occurrence A of $EncounterInpatient

Body

QDM

- Describes clinical concepts in a standardized format;
- Enables automation of structured data;
- Provides a structure for describing clinical concept
- Allows individuals to monitor clinical performance and outcomes

A **value set** is a set of values that define clinical concepts which are derived from a particular code system to support effective health information exchange

A **code system** is a collection of coded concepts with definitions from a particular taxonomy, vocabulary, or classification system

VSAC

- Authority and central repository for the official versions of value sets Meaningful Use 2014 Clinical Quality Measures (CQMs).
- A central repository for organizations' eCQM's
- Functionality allows the ability to search, retrieval and download value sets

https://vsac.nlm.nih.gov/

VSAC Search

Value Sets | **[New Value Set]** ✕

Harmonization ▼   Report ▼

Fields marked with * are mandatory

Name: *

Definition Version:
Draft ▼

Status:
Draft

OID: *

☑ Auto Generate

Note:

Purpose: Hide

Clinical Focus:

Data Element Scope:

Inclusion Criteria:

Exclusion Criteria:

Type:
Extensional ▼

Steward: *

Author: *

Code System: *
Select... ▼

Code System Version: *
▼

Value Set Code List

＋ 🗑 ↻ ⊘ Import Validate |◀ ◀◀ Page 1 of 0 ▶▶ ▶| 20 ▼   No records to view

☐	Code	Descriptor	TTY	Property	Status

|◀ ◀◀ Page 1 of 0 ▶▶ ▶| 20 ▼   No records to view

Save   **Cancel**

Code Systems | **UMLS Concepts** | My Value Sets

Search by code or term

Query: [   ]   **Search**

☐ Include inactive codes

Filter By

Code System:
All ▼

Code System Version:
All ▼

Criteria:

Code

← Add to Value Set |◀ ◀◀ Page 0 of ▶▶ ▶| 20 ▼

☐	Code	Descriptor	Code System	TTY	Property	Active	Code Syst

← Add to Value Set |◀ ◀◀ Page 0 of ▶▶ ▶| 20 ▼

Metadata Attribute Name	Metadata Attribute Value
eMeasure Title	Aspirin Prescribed at Discharge
Abbreviated Name	
eMeasure Identifier (Measure Authoring Tool)	100
eMeasure Version Number	4.0.000
NQF Number	142
GUID	bb481284-30dd-4383-928c-82385b...
Measurement Period	January 1, 20XX through December...
Measure Steward	Centers for Medicare & Medicaid Se...
Measure Developer	Oklahoma Foundation for Medical (...
Endorsed By NQF	National Quality Forum
Description	Acute myocardial infarction (AMI) p...
Copyright	Measure specifications are in the Pu... LOINC (R) is a registered trademark... This material contains SNOMED C... Organization. All rights reserved
Disclaimer	These performance measures are not... measures and specifications are prov... for the continued maintenance of th...
Measure Scoring	Proportion
Measure Type	Process
Stratification	None
Risk Adjustment	None
Rate Aggregation	None
Rationale	Aspirin therapy in patients who have... aspirin can reduce this risk by 20% (...

Population Description

Patients age 18 and older at the time of hospital admission with a principal diagnosis of Acute Myocardial Infarction (AMI) and a length of stay less than or equal to 120 days, during the measurement period.

Pseudo Logic

o AND: Age >= 18 year(s) at: Occurrence A of $EncounterInpatient
 AND: Union of:
 *"Diagnosis, Active: Acute Myocardial Infarction (AMI) (ordinality: Principal)" starts during Occurrence A of $EncounterInpatient
 *"Diagnosis, Active: Acute Myocardial Infarction (AMI) (ordinality: Principal)" starts during ("Encounter, Performed: Emergency Department Visit" <= 1 hour(s) ends before or concurrent with start of Occurrence A of

Measure Developer and/or Code List Developer	OID	Value Set Name	Type	Taxonomy	Taxonomy Version	Code System OID	Purpose
	2.16.840.1.113883.3.666.5.3011	Acute Myocardial Infarction	Grouping	ICD 10 CM SNOMED CT			
Lantana	2.16.840.1.113883.3.666.5.626	Aspirin	Extensional	RXNORM	2015-01	2.16.840.1.113883.6.88	This value set is to identify patients who are prescribed aspirin therapy at discharge following acute myocardial infarction.
Lantana	2.16.840.1.113883.3.117.1.7.1.209	Discharged to Hosp	Extensional	SNOMED CT		2.16.840.1.113883.6.96	
Lantana	2.16.840.1.113883.3.666.5.307	Encounter Inpatient	Extensional	SNOMED CT		2.16.840.1.113883.6.96	
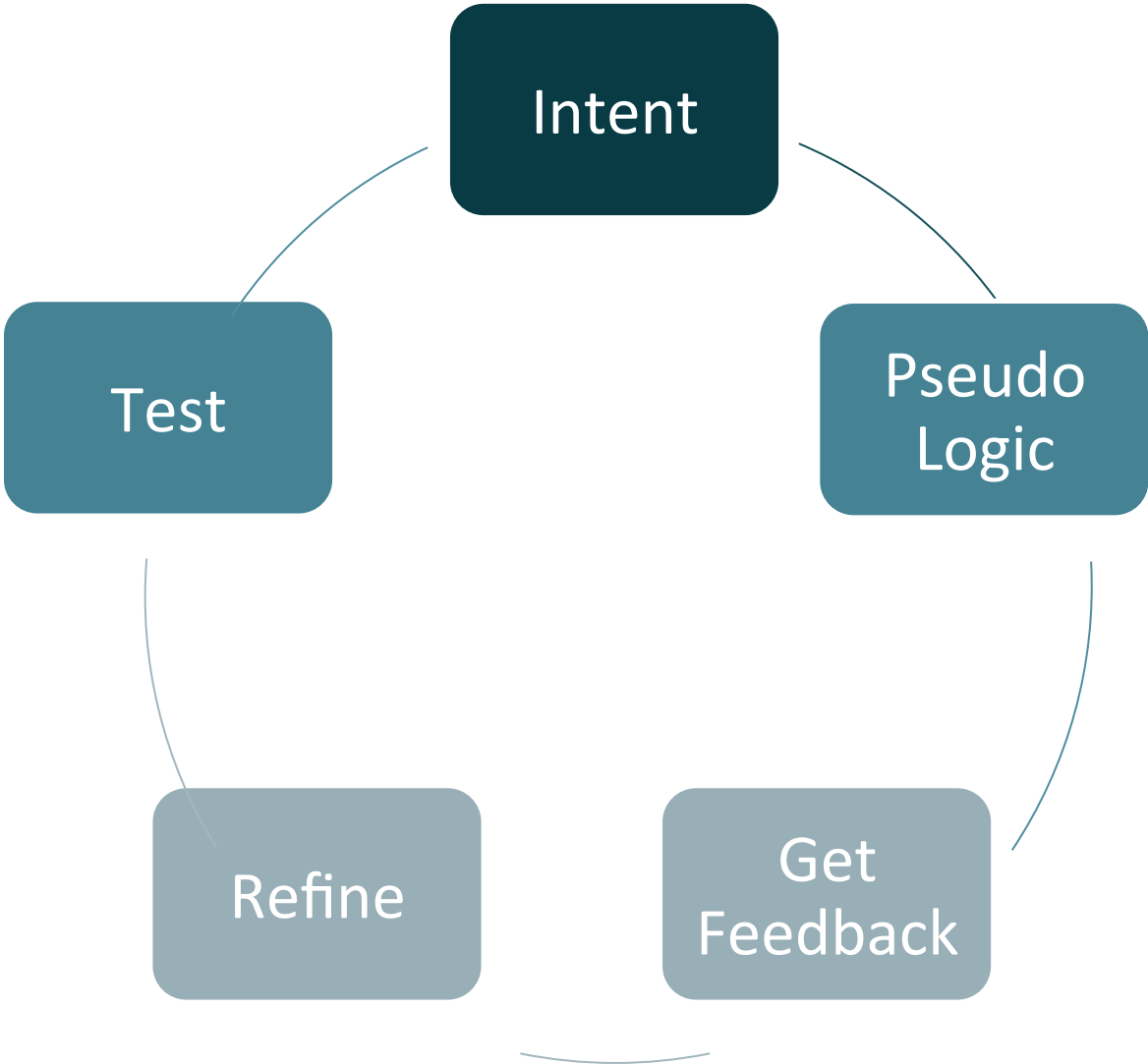
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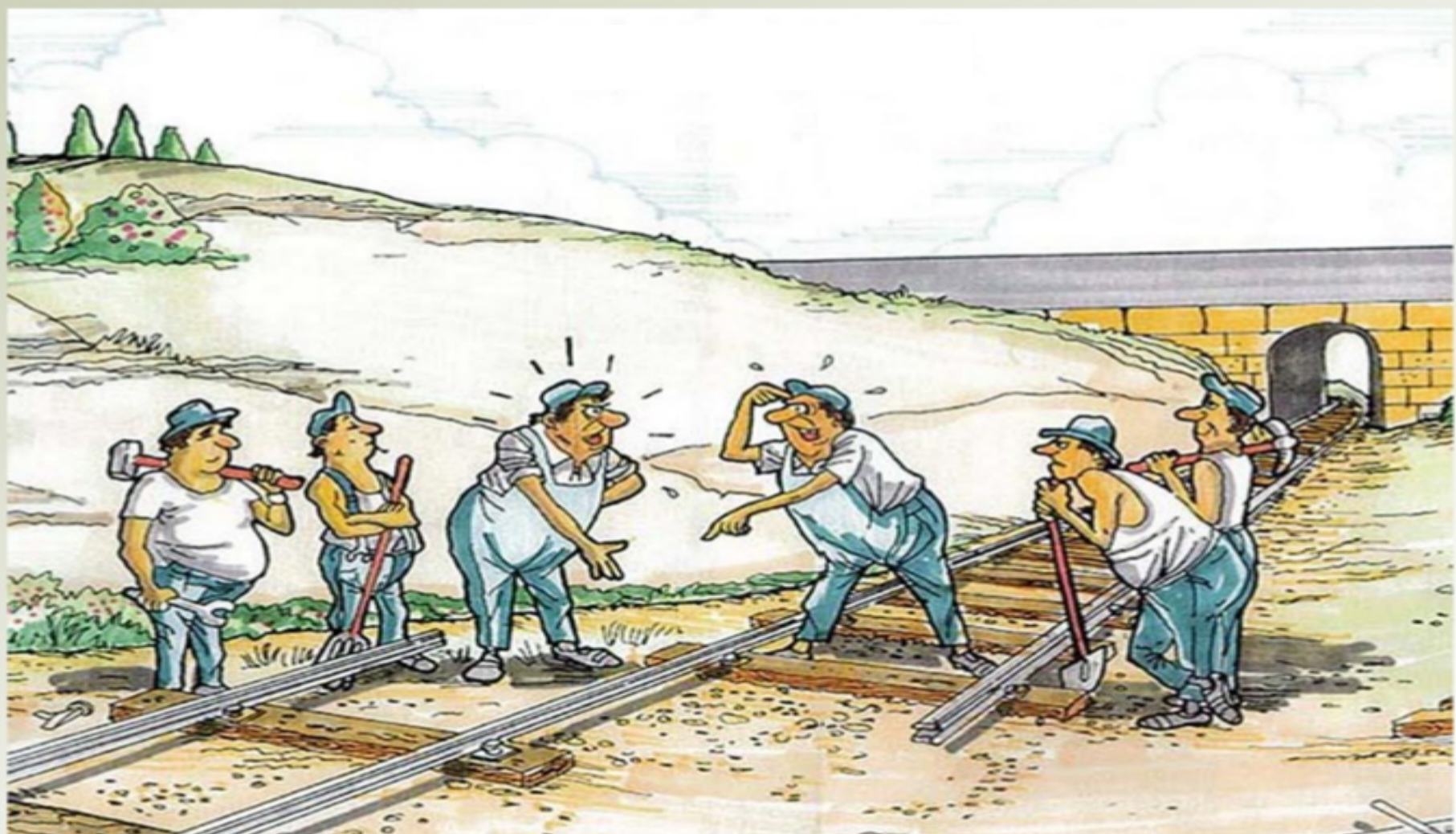
- The Measure Authoring Tool (MAT) guides measure developers through the progressions to create an eCQM.
- The tool allows measure developers to create their eCQMs in a highly structured format.
- The MAT permits exportation of a human readable format of the measure.

Measure Details	QDM Elements	► Clause Workspace	Population Workspace	Measure Packager	Measure Notes

Users can package various combinations of populations:

- Grouping 1: Initial Population 1, Denominator 1, Numerator 1
- Grouping 2: Initial Population 1, Denominator 2, Numerator 2

Package includes:
- SimpleXML
- HTML human readable
- Value set Excel spreadsheet
- HQMF R2.1 XML file

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AMI2_v4_Artifacts.zip

Name	Type	Compressed size	Password p...	Size	Ratio	Date modified
AMI2_v4_eMeasure.xml	XML Document	14 KB	No	119 KB	89%	3/10/2015 2:34 PM
AMI2_v4_HumanReadable.html	HTML Document	6 KB	No	28 KB	82%	3/10/2015 2:34 PM
AMI2_v4_SimpleXML.xml	XML Document	7 KB	No	31 KB	79%	3/10/2015 2:34 PM
AMI2_v4_Tue Mar 10 13.34.08 CDT ...	Microsoft Excel 97-2003 ...	25 KB	No	102 KB	76%	3/10/2015 2:34 PM

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A software tool for automating:

- Testing and verifying the behavior of CQM logic
- Loading measures
- Executing synthetic patient test decks
- Validating measure logic against a constructed patient test deck
- Evaluating if the logic aligns with the intent of a measure

https://bonnie.healthit.gov/

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BONNIE

⚡ **Dashboard**   ⚠ **Complexity**   ✏ **Account**   ❓ **Help ▾**   ➡ **Logout**

🕒 Measure Period: 2012

☰ **MEASURES** ⬇		⬆ **UPLOAD**	**EXPECTED**	**STATUS**	**TEST PATIENTS**	
Primary PCI Received Within 90 Minutes of Hospital Arrival	CMS53v4	⟳ UPDATE	0	**NEW**	0 /0	👤+
Aspirin Prescribed at Discharge	CMS100v4	⟳ UPDATE	95	FAIL	19 /20	👤+
Diabetes Care for People with Serious Mental Illness: Blood Pressure Control (140/90 mm Hg)	CMSv0	⟳ UPDATE	100	PASS	25 /25	👤+
Diabetes Care for People with Serious Mental Illness: Hemoglobin A1c (HbA1c) Testing	CMSv0	⟳ UPDATE	100	PASS	20 /20	👤+

☰ CMS100V4 ⚙

ASPIRIN PRESCRIBED AT DISCHARGE

Episode(s) of Care:
- Occurrence A of $EncounterInpatient

Acute myocardial infarction (AMI) patients who are prescribed aspirin at hospital discharge

Complexity: ⚠

Initial Population: ⌄

AND : Patient Characteristic Birthdate: Birth >= 18 years starts before start of Occurrence A: $Occurrence A of $EncounterInpatient

AND :
    UNION OF:
- Diagnosis, Active: Acute Myocardial Infarction (Ami) (Ordinality : Principal) starts during Occurrence A: $Occurrence A of $EncounterInpatient
- Diagnosis, Active: Acute Myocardial Infarction (Ami) (Ordinality : Principal) starts during Encounter, Performed: Emergency Department Visit <= 1 hour ends before or concurrent with start Occurrence A: $Occurrence A of $EncounterInpatient

Denominator: ⌄

None

👤 TEST PATIENTS ⚙

| | 95 | FAIL | 19 /20 | 👤+ |

| | 79 | % COVERAGE | |

✖ 👤 IPP Age1	FAIL ›
✔ 👤 NUM Aspirin	PASS ›
✔ 👤 NumsFail 10 (1)	PASS ›
✔ 👤 Test1 IPP	PASS ›
✔ 👤 Test1 IPP	PASS ›
✔ 👤 Test10 ASAbefore	PASS ›
✔ 👤 Test11 Anticoag	PASS ›
✔ 👤 Test12 CM	PASS ›

TEST PATIENT

CANCEL SAVE

LAST NAME

IPP

FIRST NAME

Age1

PATIENT DESCRIPTION

Patient is...

DATE OF BIRTH

11/04/1955   8:00 AM

LIVING STATUS

☐ Deceased

RACE

American Indian or Alaska Nativ ▼

GENDER

Male ▼

ETHNICITY

Not Hispanic or Latino ▼

PAYER

Other ▼

ASPIRIN PRESCRIBED AT DISCHARGE

Acute myocardial infarction (AMI) patients who are prescribed aspirin at hospital discharge

Show more

EXPECTED VALUE

IPP 1 ↕   DENOM 1 ↕   DENEX 1 ↕

NUMER 0 ↕   DENEXCEP 0 ↕

ELEMENTS

CONDITIONS >

ENCOUNTERS >

INTERVENTIONS >

PATIENT HISTORY

DIAGNOSIS	DATE
Active: Acute Myocardial Infarction (AMI)	11/05/2012 – 11/05/2012

ENCOUNTER	DATE
Performed: Emergency Department Visit	11/05/2012 – 11/05/2012

ENCOUNTER	DATE

☰ CMS100V4

✔ INITIAL POPULATION: ⌄

✔ AND : ✔ Patient Characteristic Birthdate: Birth >= 18 years starts before start of ✔ Occurrence A: $Occurrence A of $EncounterInpatient
✔ AND :
✔ UNION OF:
✘ Diagnosis, Active: Acute Myocardial Infarction (Ami) (Ordinality : Principal) starts during ✔ Occurrence A: $Occurrence A of $EncounterInpatient
✔ Diagnosis, Active: Acute Myocardial

Feasibility Evaluation
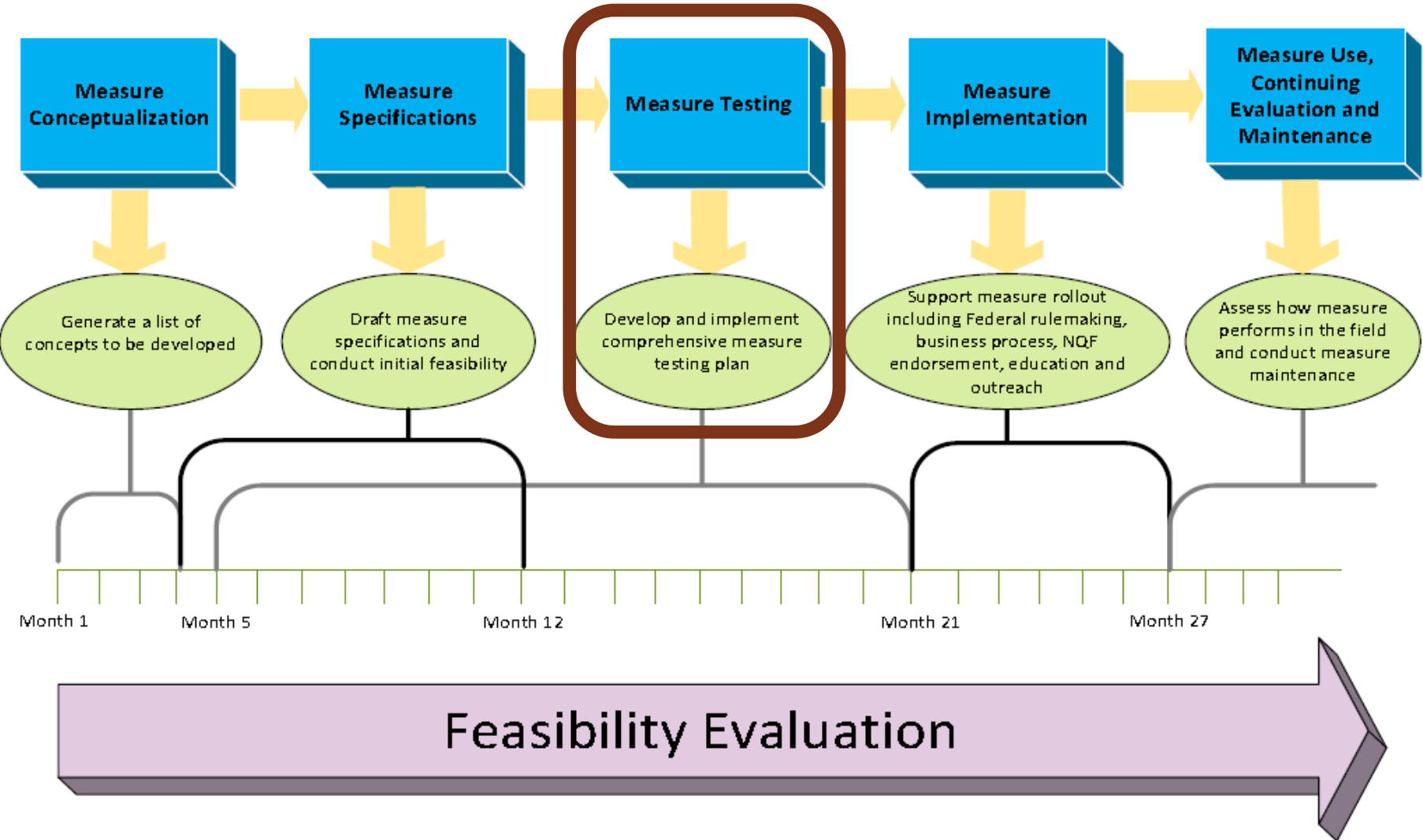
Alpha Testing

- Evaluates the feasibility and availability of data in a structured format within the EHR
- Focuses on identifying any logic ambiguities and vocabulary inconsistencies

Beta Testing

- Provides evidence of measure reliability across providers and uncovers variability in provider performance or the relationship of the measure results to patient outcomes
- Evaluates the ability to capture and report data from EHR systems.

Test Plan

Describes the objectives and methods for testing a single or set of measures

Summary Report

Describes the test(s) performed on an eMeasure
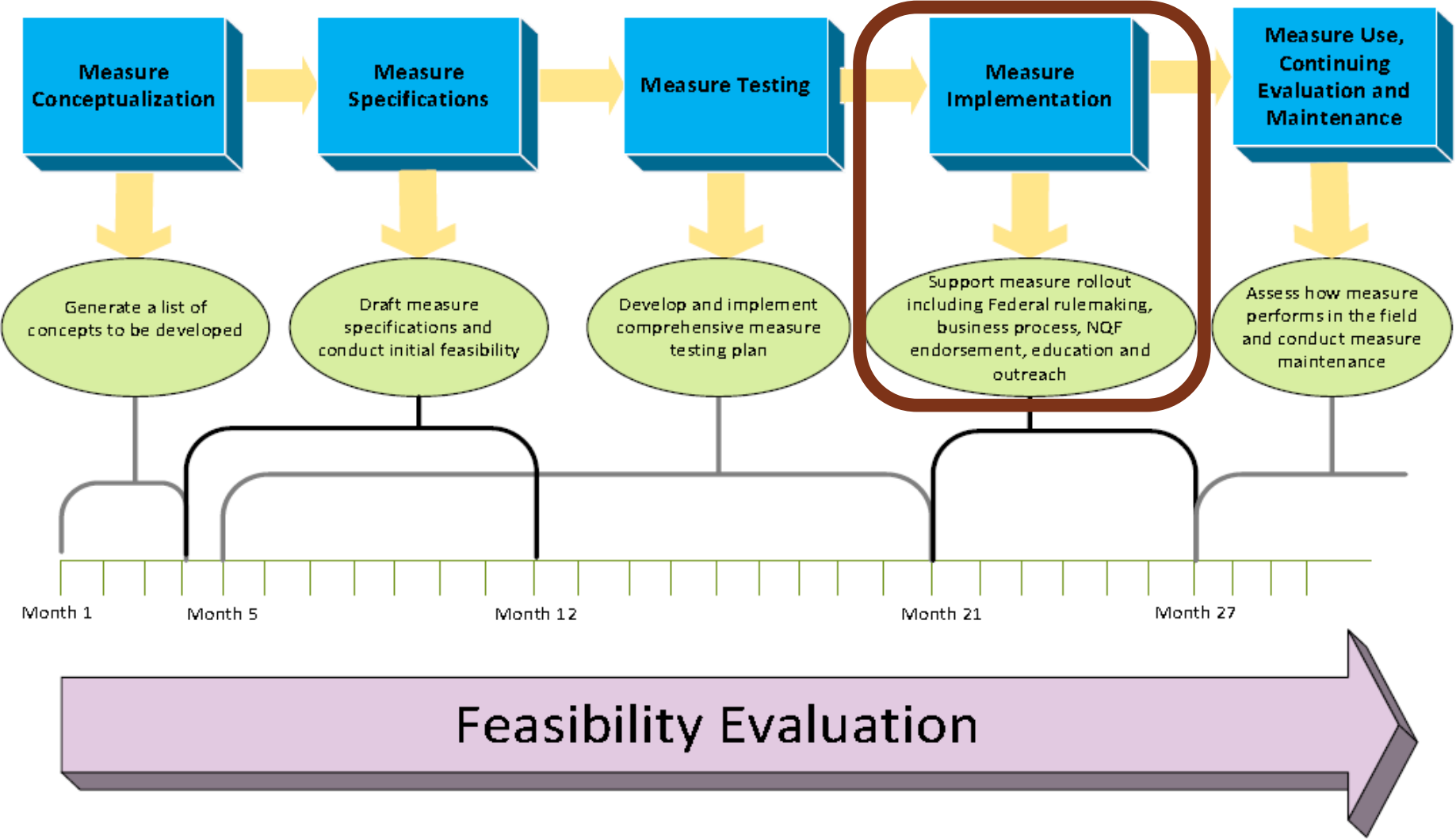
National Quality Forum (NQF) endorsement criteria:

- Importance to measure and report
- Scientific acceptability of measure properties
- Usability
- Feasibility

https://www.qualityforum.org/Projects/e-g/eMeasure_Feasibility_Testing/eMeasure_Feasibility_Testing.aspx.)
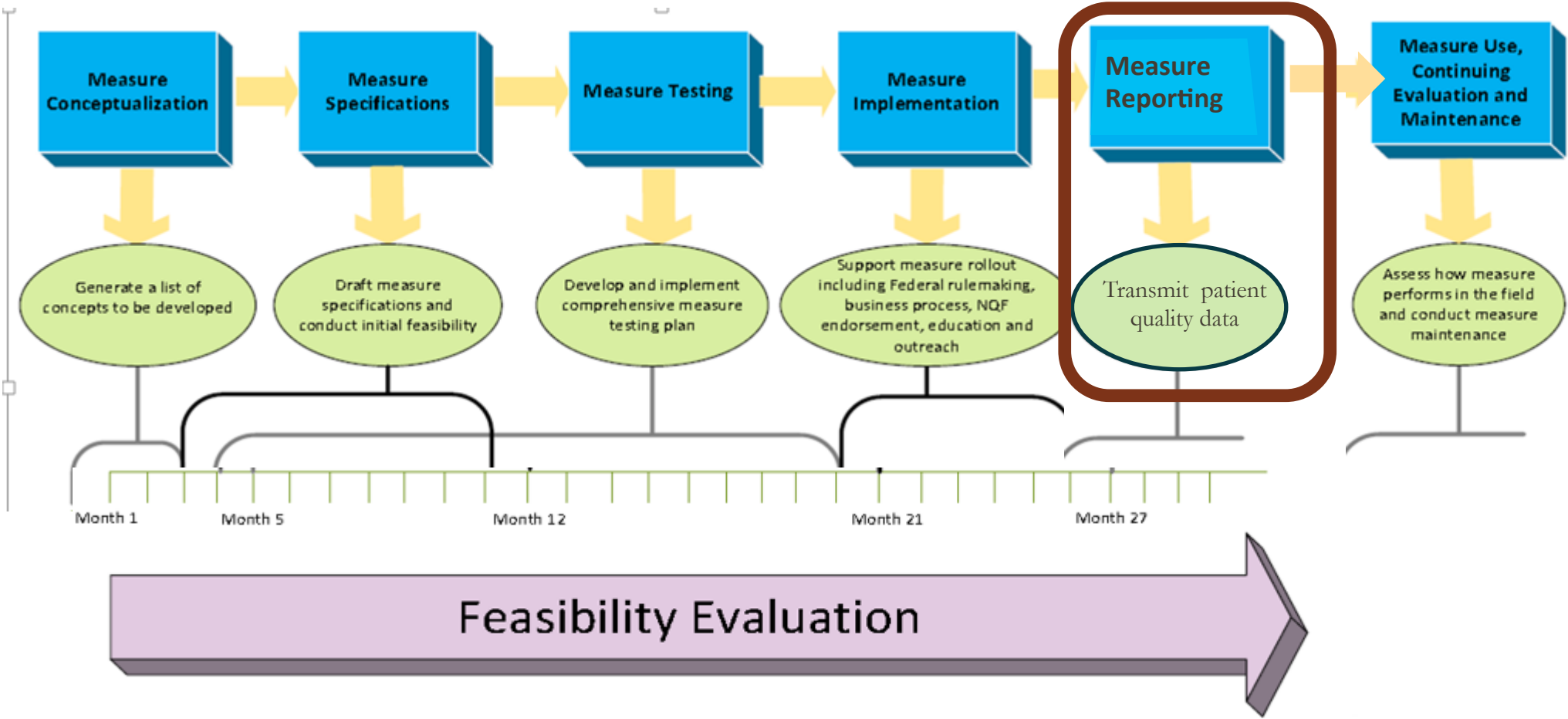
QRDA Category I – Single Patient Report

Patient	Eve Everygirl
Date of birth	February 1, 2002
Sex	Female
Race	White
Ethnicity	Not Hispanic or Latino
Contact info	2222 Home Street Burlington, MA 02368, USA Tel: (781)555-1212
Patient IDs	111223333A 2.16.840.1.113883.4.572
Document Id	5b010313-eff2-432c-9909-6193d8416fac
Document Created:	December 31, 2011
Performer	

Measure Section

eMeasure Title	Version neutral identifier	eMeasure Version Number	NQF eMeasure Number
Children's Asthma Care (CAC-1) Relievers for Inpatient Asthma	dc78ee5d-1487-4d79-84c3-1dfdaff0781c	1	0143

Reporting Parameters

- Reporting period: 01 Jan 2011 - 31 Dec 2011

Patient Data

| Data Element	Value
Encounter, Performed: Emergency Department Visit	Emergency Department visit
Encounter, Performed: Encounter Inpatient	Hospital admission
Diagnosis, Active: Asthma	Asthma
Medication, Administered: Asthma Reliever	Albuterol 1.25 MG (albuterol sulfate 1.5 MG) per 3 ML Inhalant Solution
Patient Characteristic Clinical Trial Participant	True
Patient Characteristic Payer	Medicare

QRDA Category III - Aggregate Report

Document Id	26a42253-99f5-48e7-9274-b467c6c7f623
Document Created:	May 13, 2012
Performer	
Author	SOME Data Aggregator Transform Tool KP00017dev
Author	Henry Seven, Good Health Hospital
{$classCode='RGPR'?}	medical record, device
Legal authenticator	Good Health Hospital signed at August 11, 2012
Document maintained by	Good Health Hospital

Reporting Parameters

- Reporting period: 01 January 2012 - 31 March 2012
- First encounter: 05 January 2012
- Last encounter: 24 March 2012

Measure Section

eMeasure Title	Version neutral identifier	eMeasure Version Number	NQF eMeasure Number	eMeasure Identifier (MAT)	Version specific identifier
Anticoagulation Therapy for Atrial Fibrillation/Flutter	03876d69-085b-415c-ae9d-9924171040c2	1	0436	71	8a4d92b2-3887-5df3-0139-013b0c87524a

Member of Measure Set: Clinical Quality Measure Set 2011-2012 - b6ac13e2-beb8-4e4f-94ed-fcc397406cd8

- Performance Rate: 83% (Predicted = 62%)
- Reporting Rate: 84%
- Initial Patient Population: 1000
  - Male: 400
  - Female: 600
  - Not Hispanic or Latino: 350
  - Hispanic or Latino: 650
  - Black: 300
  - White: 350
  - Asian: 350
  - Payer - Medicare: 250
  - Payer - Medicaid: 550
  - Zipcode 92543: 15
- Denominator: 500
  - Male: 200
  - Female: 300

QRDA Category I coupled with

- QDM
- QDM-based HQMF Implementation Guide
- MAT

- **QRDA Category III** evolves based on reporting requirements
- No synchronized versioning

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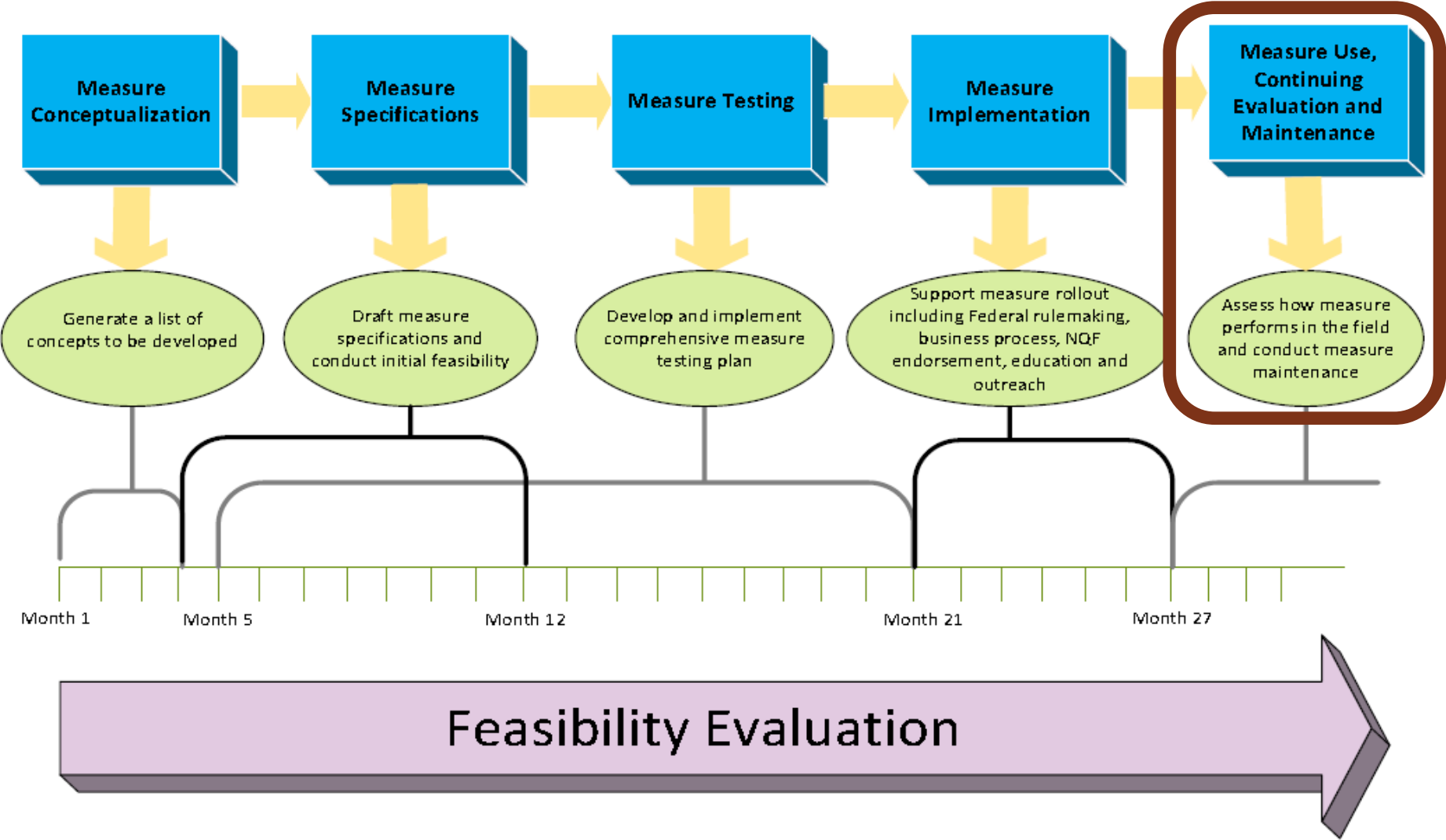
- Updated eSpecifications

- Feedback review of JIRA comments

- Release notes

- An updated Measure Justification Form

- An updated Measure Evaluation Report

- NQF endorsement maintenance

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CMS	Centers for Medicare and Medicaid Services
CPHIMS	Certified Professional Health Information Systems
CPT	Current Procedural Terminology
EHR	Electronic Health Record
eCQM	electronic Clinical Quality Measures
HL7	Health Level 7
HQMF	Health Quality Measure Format
HTML	HyperText Markup Language
ICD 10	International Classification of Disease, 10th Revision
IHTSDO	International Health Terminology Standards Development Organisation
LOINC	Logical Observation Identifiers Names and Codes
MAT	Measure Authoring Tool
MAX	Maximum
MIN	Minimum

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MP	Measurement Period
MSN	Master Science Nursing
NQF	National Quality Forum
ONC	Office of the National Coordinator for Health Information Technology
PHR	Personal Health Record
QA	Quality Assurance
QDM	Quality Data Model
QRDA	Quality Reporting Document Architecture
RN	Registered Nurse
SNOMED CT	Systematized Nomenclature of Medicine –Clinical Terms
VSAC	Value Set Authoring Center
XML	Extensible Markup Language

RESOURCES

A Blueprint for the CMS Measures Management System. Version 11.1 (August 2015)

Bonnie User Guide Initial Draft, Version 0.2, April 13, 2015

Measure Authoring Tool v4.3.0 User Guide

Quality Data Model, Version 4.2 August 31, 2015

Value Set Authoring Center (VSAC) https://vsac.nlm.nih.gov/#

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