



# Quality Measures mit CQL & FHIR

HL7 Austria, 16.03.2023

Anna Lin · Anja Schwab

# Über uns...

Anna Lin



Anja Schwab



# Agenda

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09:00 Was sind Electronic Health Quality Measures?



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09:20 Beispiel: Impfplan Österreich



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09:40 FHIR: Test-Daten und Terminologie



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10:00 Kaffeepause



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10:30 CQL: Logik-Definitionen



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11:15 Wie kommt alles zusammen?



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11:45 Was ist das Resultat?





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## Was sind Electronic Health Quality Measures?



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Beispiel: Impfplan Österreich



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FHIR: Test-Daten und Terminologie



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Kaffeepause



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CQL: Logik-Definitionen



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Wie kommt alles zusammen?



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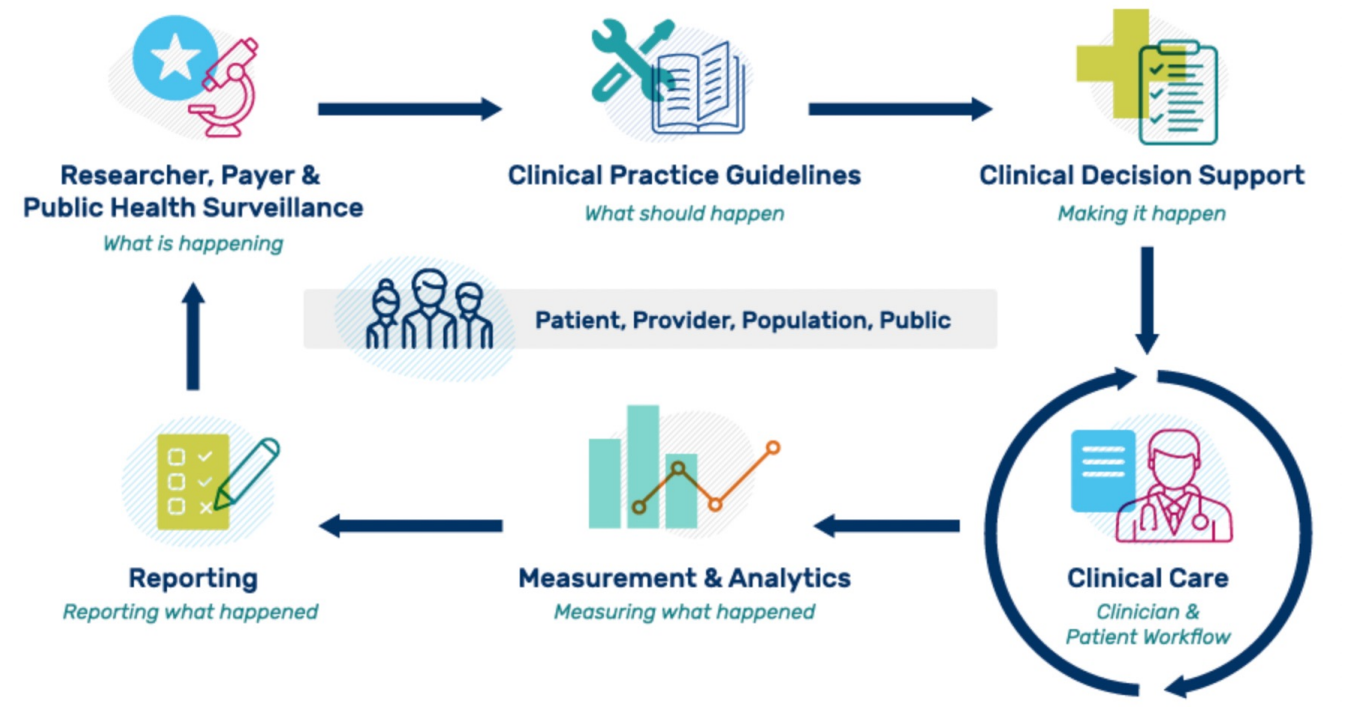
Was ist das Result?





# Diagramm: Ökosystem der Qualitätsverbesserung

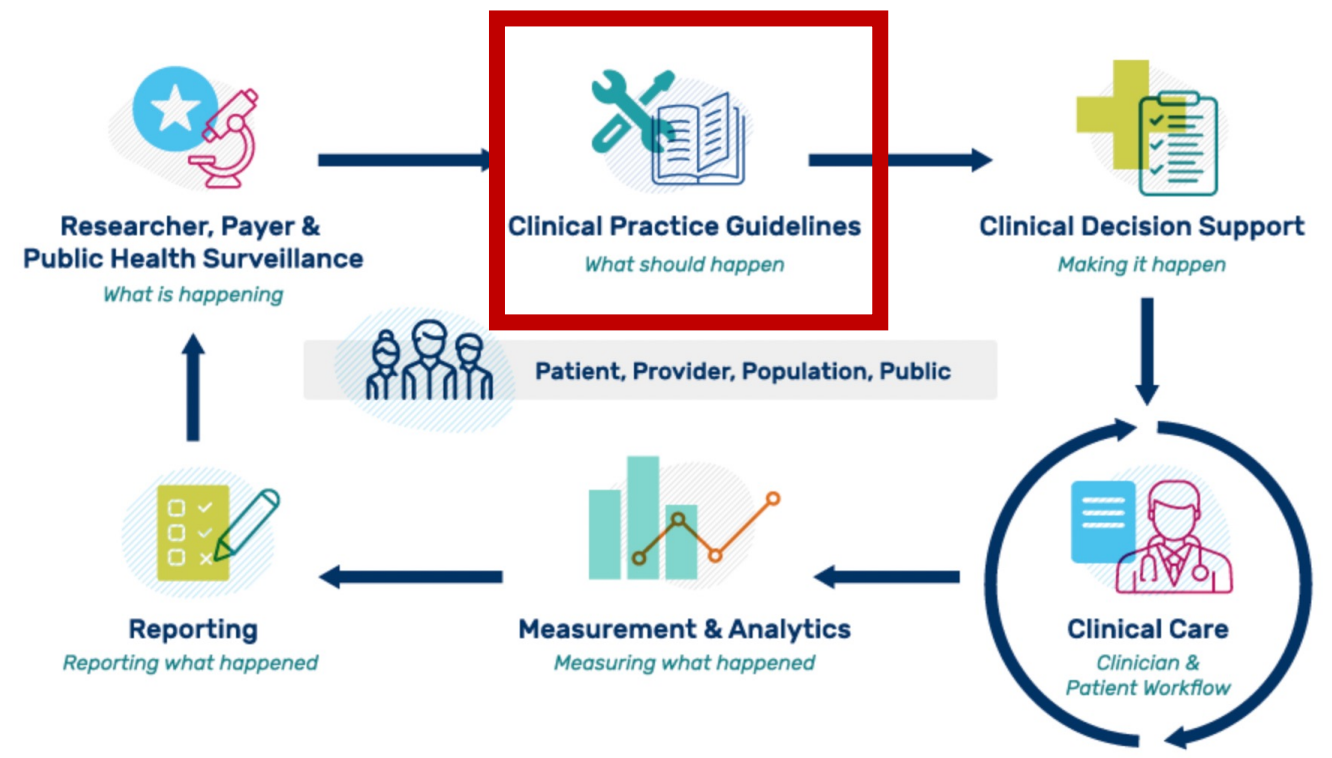
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# Diagramm: Ökosystem der Qualitätsverbesserung

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# Guideline: Brustkrebs-Screening Österreich

## Screening-Programm: Brustkrebs-Früherkennung

### Allgemeines

Seit 2014 gibt es in Österreich ein nationales, qualitätsgesichertes Programm zur Früherkennung von Brustkrebs mit niederschwelligem Zugang (automatische Freischaltung der e-card). Zusätzlich zur Mammographie ist auch eine Ultraschall-Untersuchung im Screening-Programm enthalten. Die Teilnahme am Früherkennungsprogramm ist nicht verpflichtend.

### Ablauf

Im Zuge des Brustkrebs-Früherkennungsprogramms werden **alle in Österreich sozialversicherten Frauen** zwischen 45 und 69 Jahren alle zwei Jahre zu einer Früherkennungs-Mammografie aufgefordert. Die betreffenden Frauen werden automatisch schriftlich an die Untersuchung erinnert. Die Einladungsbriefe werden von der Koordinierungsstelle des Österreichischen Brustkrebs-Früherkennungsprogramms verschickt. Diese bekommt die Adresse vom jeweiligem Krankenversicherungsträger.



# Guideline: Brustkrebs-Screening Österreich

## Screening-Programm: Brustkrebs-Früherkennung

### Allgemeines

Seit 2014 gibt es in Österreich ein nationales, qualitätsgesichertes Programm zur Früherkennung von Brustkrebs mit niederschwelligem Zugang (automatische Freischaltung der e-card). Zusätzlich zur Mammographie ist auch eine Ultraschall-Untersuchung im Screening-Programm enthalten. Die Teilnahme am Früherkennungsprogramm ist nicht verpflichtend.

### Ablauf

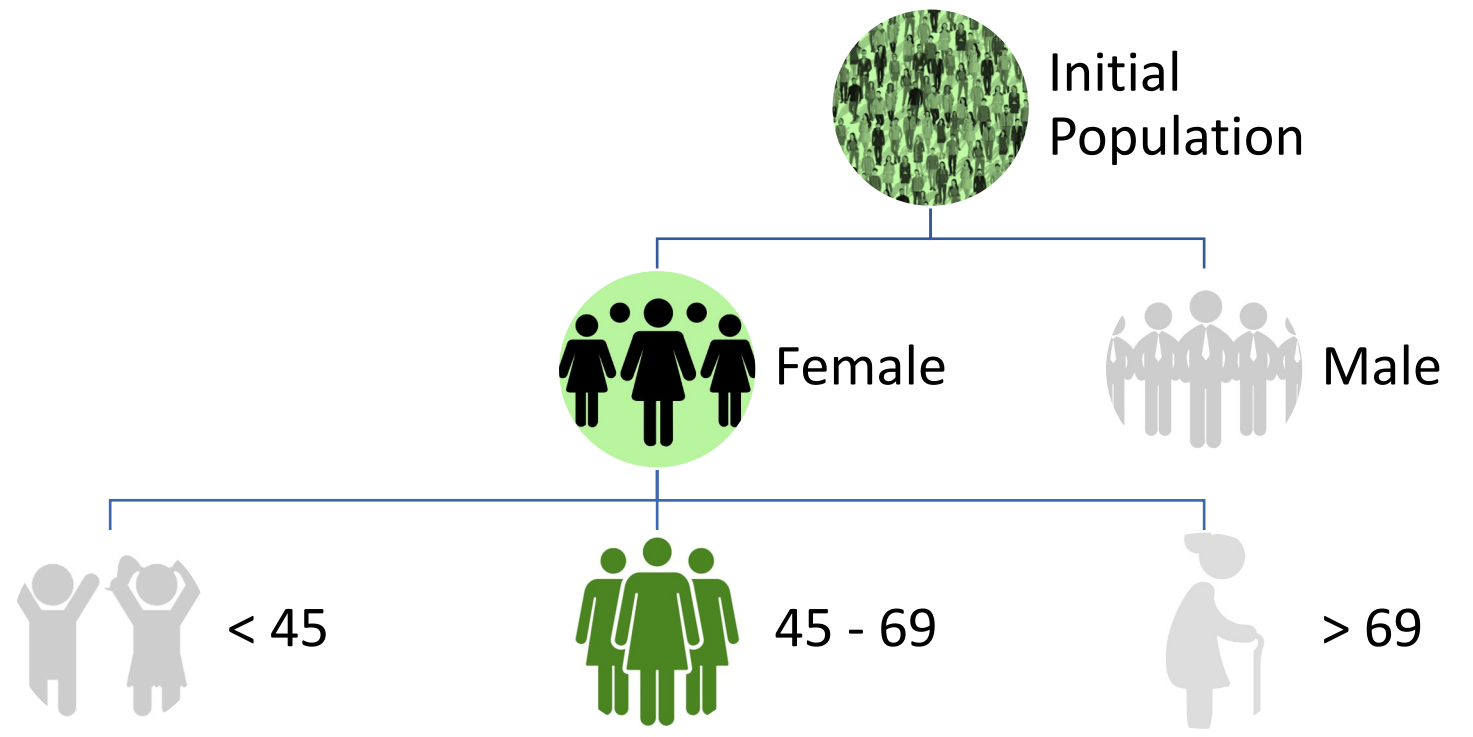
Im Zuge des Brustkrebs-Früherkennungsprogramms werden **alle in Österreich sozialversicherter Frauen** zwischen **45** und **69 Jahren** alle zwei Jahre zu einer Früherkennungs-Mammografie aufgefordert. Die betreffenden Frauen werden automatisch schriftlich an die Untersuchung erinnert. Die Einladungsbriefe werden von der Koordinierungsstelle des Österreichischen Brustkrebs-Früherkennungsprogramms verschickt. Diese bekommt die Adresse vom jeweiligem Krankenversicherungsträger.





# Populations

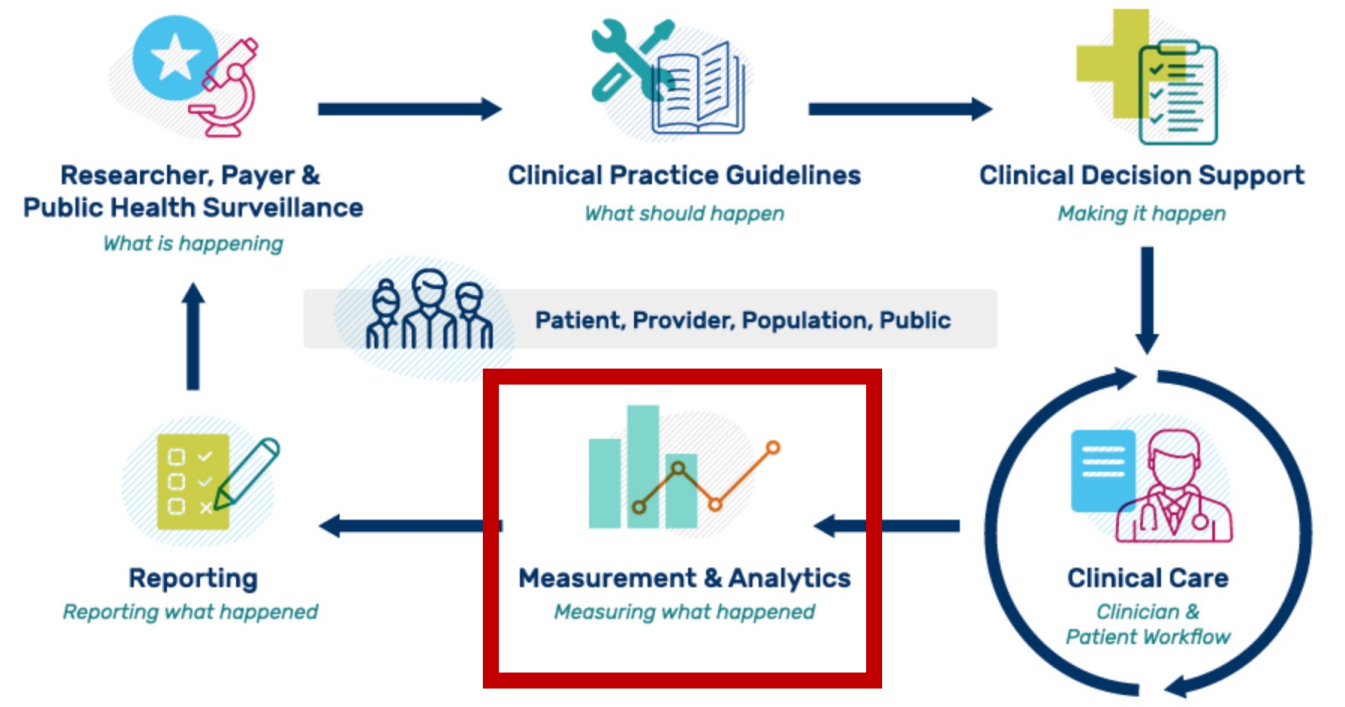
Brustkrebs-Screening  
Österreich





# Diagramm: Ökosystem der Qualitätsverbesserung

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# Populations: % Screening

<https://mmshub.cms.gov/sites/default/files/Measure-Calculations.pdf>

Initial Population: Alle Frauen zwischen 45-69 Jahren

Numerator: Alle, die in den letzten 2 Jahren das Brustkrebs-Screening machten

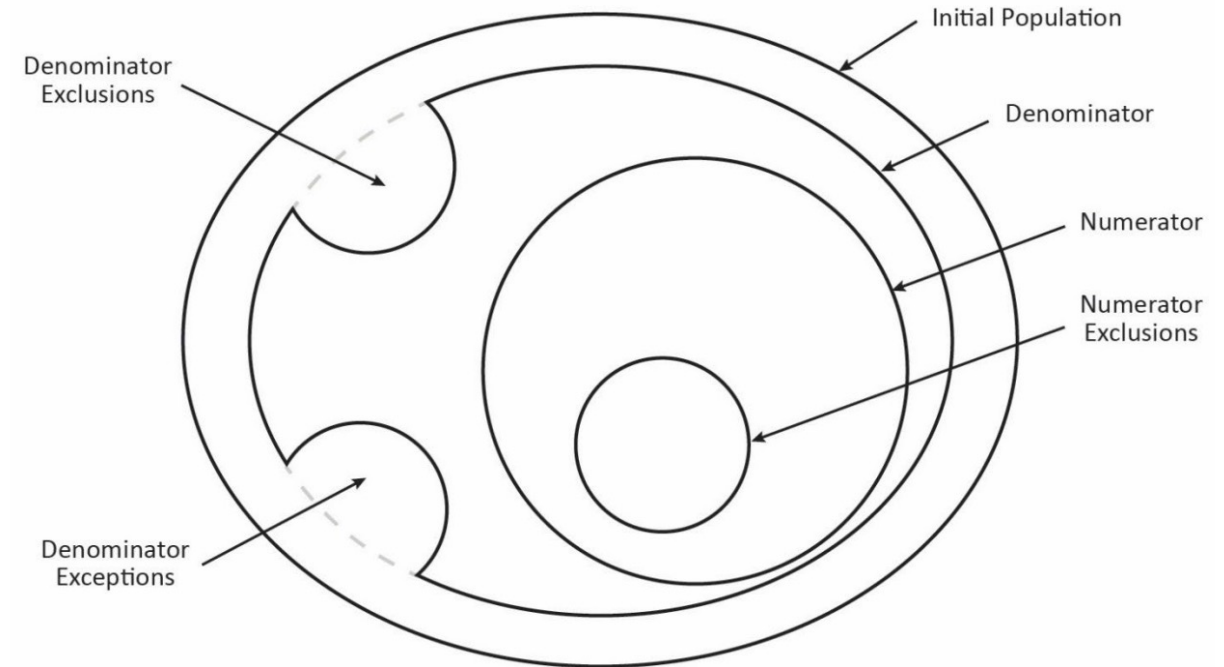


Figure 1. Proportion Measure Populations



# Population: % Screening



ecqi.healthit.gov/ecqm/ec/2022/cms125v10



## Initial Population

Women 51-74 years of age with a visit during the measurement period

## Denominator

Equals Initial Population

## Denominator Exclusions

Women who had a bilateral mastectomy or who have a history of a bilateral mastectomy or for whom there is evidence of a right and a left unilateral mastectomy.

Exclude patients who are in hospice care for any part of the measurement period.

Exclude patients 66 and older who are living long term in an institution for more than 90 consecutive days during the measurement period.

Exclude patients 66 and older with an indication of frailty for any part of the measurement period who meet any of the following criteria:

- Advanced illness with two outpatient encounters during the measurement period or the year prior
- OR advanced illness with one inpatient encounter during the measurement period or the year prior
- OR taking dementia medications during the measurement period or the year prior

Exclude patients receiving palliative care during the measurement period.

## Numerator

Women with one or more mammograms during the 27 months prior to the end of the measurement period



## Population: % Screening

- 48 eCQMs für 2022 in: [https://ecqi.healthit.gov/ep-ec?qt-tabs\\_ep=1](https://ecqi.healthit.gov/ep-ec?qt-tabs_ep=1)
- Je genauer Populations definiert werden können, desto genauer kann das Resultat interpretiert werden



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Was sind Electronic Health Quality Measures?



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**Beispiel: Impfplan Österreich**



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FHIR: Test-Daten und Terminologie



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Kaffeepause



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CQL: Logik-Definitionen



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Wie kommt alles zusammen?



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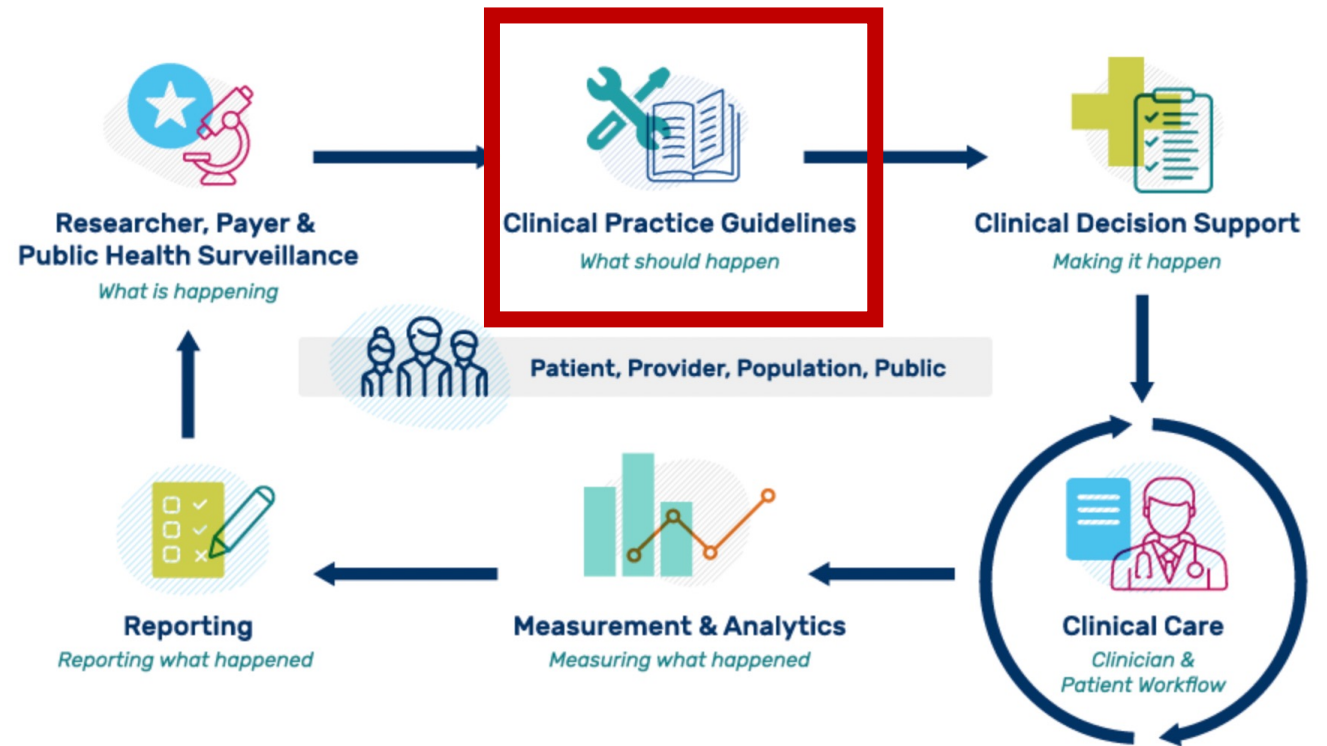
Was ist das Result?





# Diagramm: Ökosystem der Qualitätsverbesserung

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# Impfplan Österreich

Alter →	Vollend. 9. Monat					1. Geburtstag			2. Geburtstag				
	in der 7. Lebens-woche	im 3. Monat	im 4.–5. Monat	im 6. Monat	im 7.–9. Monat	im 10.–11. Monat	im 12. Monat	im 13. Monat	im 14. Monat	im 15. Monat	im 16.–19. Monat	im 20.–24. Monat	im 3.–5. Jahr
Impfung ↓													
Rotavirus <sup>a</sup>	1	2	3										
Diphtherie													
Tetanus													
Pertussis													
Poliomyelitis		1	2										
Haemophilus influenzae B													
Hepatitis B													
Pneumokokken		1	2										e
Masern, Mumps, Röteln								1					

Timeline details:

- Rotavirus: 1 (4 Wochen), 2 (4 Wochen), 3
- Pertussis: 1 (2 Monate), 2 (6 Monate), 3
- Poliomyelitis: 1 (2 Monate), 2 (6 Monate), 3
- Pneumokokken: 1 (2 Monate), 2 (6 Monate), 3
- Masern, Mumps, Röteln: 1 (3 Monate), 2 f vor Eintritt in Gemeinschaftseinrichtungen





# Impfplan Österreich: Kriterien

- Alter
- Impfstoff
- Intervall
- Fokus auf 6-Fach Impfung

Impfung ↓	Alter →	Vollend. 9. Monat				1. Gebu	
	in der 7. Lebens-woche	im 3. Monat	im 4.-5. Monat	im 6. Monat	im 7.-9. Monat	im 10.-11. Monat	im 12. Monat
Rotavirus <sup>a</sup>		1 [4 Wochen]	2 [4 Wochen]	3			
Diphtherie							
Tetanus							
Pertussis							
Poliomyelitis		1	2 [2 Monate]		3 [6 Monate]		
Haemophilus influenzae B							
Hepatitis B							



# Problem Impf-Analysen

- Derzeitige Impf-Erfassung:
  - Zählen der verabreichten Dosen
  - Studien von repräsentativen Haushalten



# Problem Impf-Analysen

- Derzeitige Impf-Erfassung:
  - Zählen der verabreichten Dosen → **ungenau**
  - Studien von repräsentativen Haushalten → **langsam**
- Ziel: On-Demand Erfassung von Personen-Level Daten:
  - IHE Quality Research and Public Health (QRPH) White Paper: Extracting Indicators from Person Level Data
  - [https://www.ihe.net/uploadedFiles/Documents/QRPH/IHE\\_QRPH\\_White\\_Paper\\_CQL\\_Rev1-0\\_PC\\_2021-10-26.pdf](https://www.ihe.net/uploadedFiles/Documents/QRPH/IHE_QRPH_White_Paper_CQL_Rev1-0_PC_2021-10-26.pdf)



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Was sind Electronic Health Quality Measures?



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Beispiel: Impfplan Österreich



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**FHIR: Test-Daten und Terminologie**



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Kaffeepause



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CQL: Logik-Definitionen



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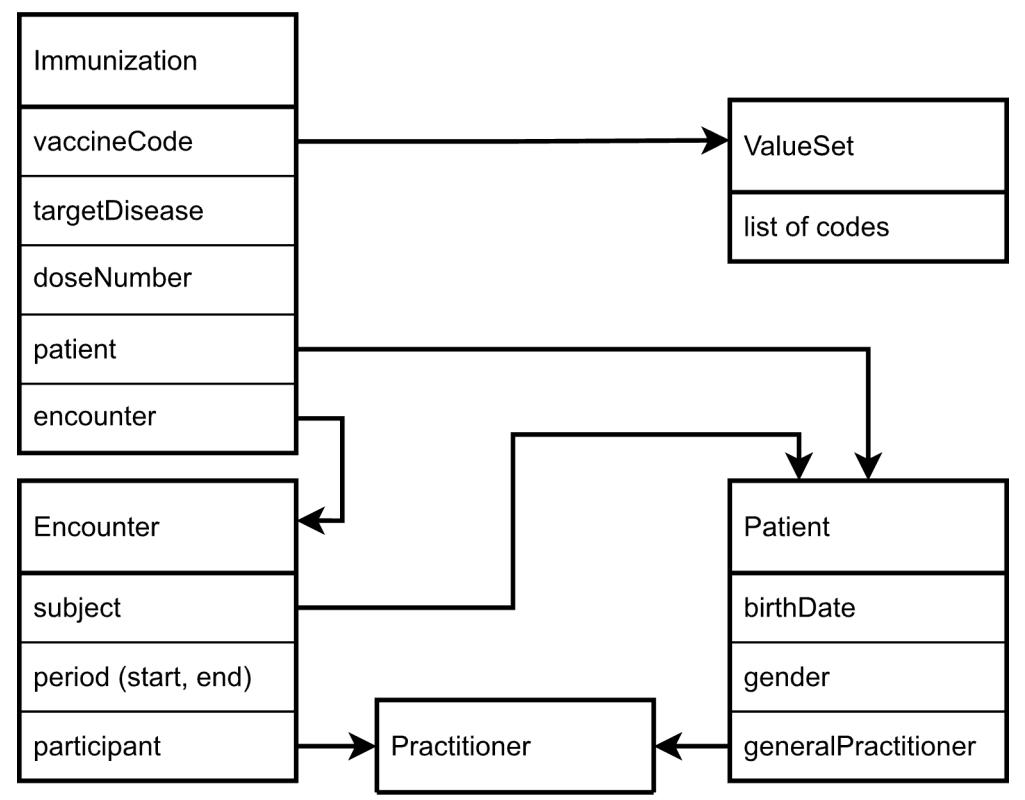
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Was ist das Result?





# FHIR Resources: Use Case Immunization





# FHIR Test-Daten

- FHIR Patient, Immunization, ValueSet
- Test-Server
  - Server-Base: <http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir>
  - CQF-Ruler → HAPI FHIR based <https://github.com/cqframework/cqf-ruler>
- Beispiel um alles von einem Patienten abzufragen:
  - GET [http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Patient/ImmunizationStatus-1-year-patient-1/\\$everything](http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Patient/ImmunizationStatus-1-year-patient-1/$everything)





# Details zu Test-Patienten

id	Alter zum 15.09.2022	1. 6-Fach Impfung	2. 6-Fach Impfung	3. 6-Fach Impfung
ImmunizationStatus-cut-off-age-group-patient-1	2 Wochen			
ImmunizationStatus-2-month-patient-1	2 Monate			
ImmunizationStatus-2-month-patient-2	2 Monate			
ImmunizationStatus-4-month-patient-1	4 Monate			
ImmunizationStatus-4-month-patient-1	4 Monate			
ImmunizationStatus-6-month-patient-1	6 Monate			
ImmunizationStatus-6-month-patient-2	6 Monate			
ImmunizationStatus-1-year-patient-1	1 Jahr			
ImmunizationStatus-1-year-patient-2	1 Jahr			
ImmunizationStatus-4-year-patient-1	4 Jahre			
ImmunizationStatus-4-year-patient-2	4 Jahre			
ImmunizationStatus-4-year-patient-3	4 Jahre			



...bis 10:30

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Was sind Electronic Health Quality Measures?



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Beispiel: Impfplan Österreich



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FHIR: Test-Daten und Terminologie



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**Kaffeepause**



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**CQL: Logik-Definitionen**



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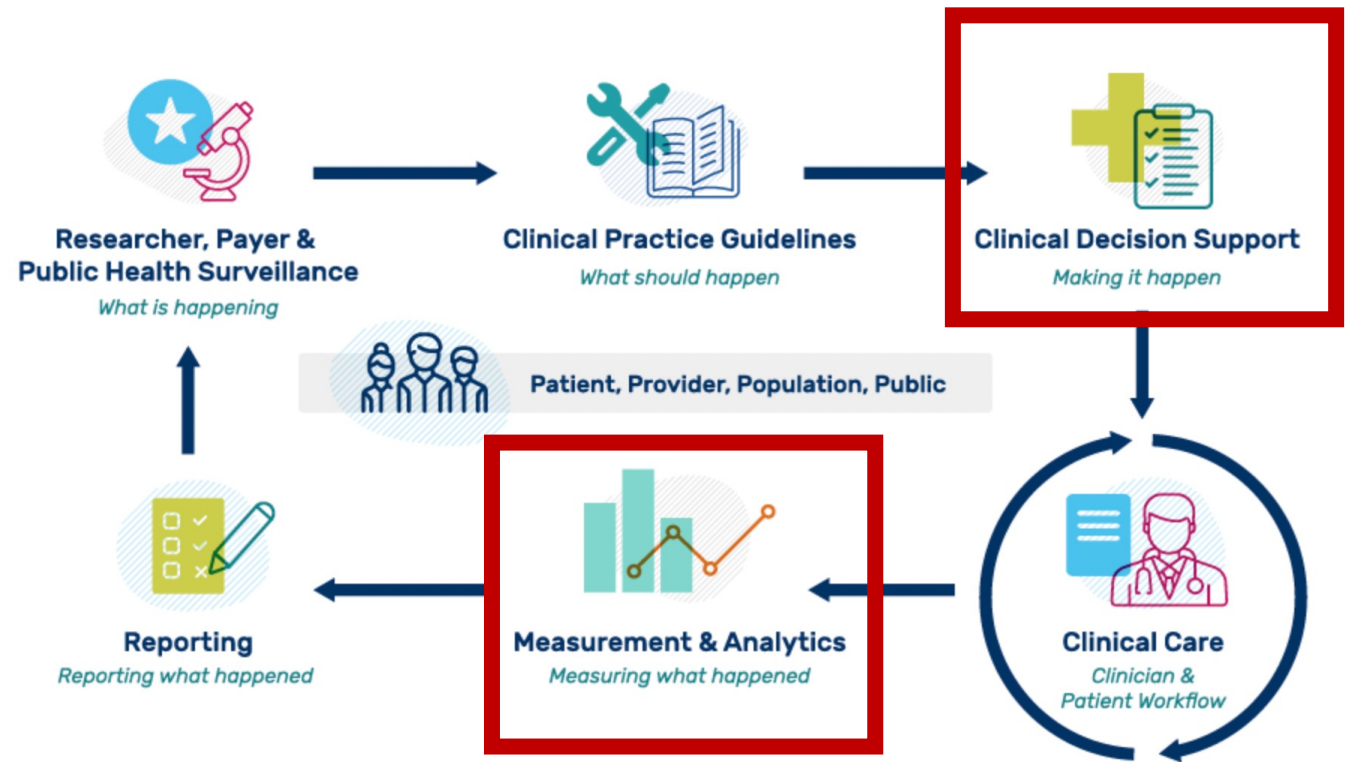
# Clinical Quality Language (CQL)

- HL7 Standard: <https://cql.hl7.org/>, seit 2020 normativ
- Ziel: Harmonisierung von Standards zur Spezifikation von Clinical Decision Support (CDS) und Clinical Quality Measurement (CQM) → Teilen von Logik-Definitionen
- Teilen der Logik, während Modell und Terminologie unabhängig definiert werden kann
- Kompatibel mit QDM, FHIR



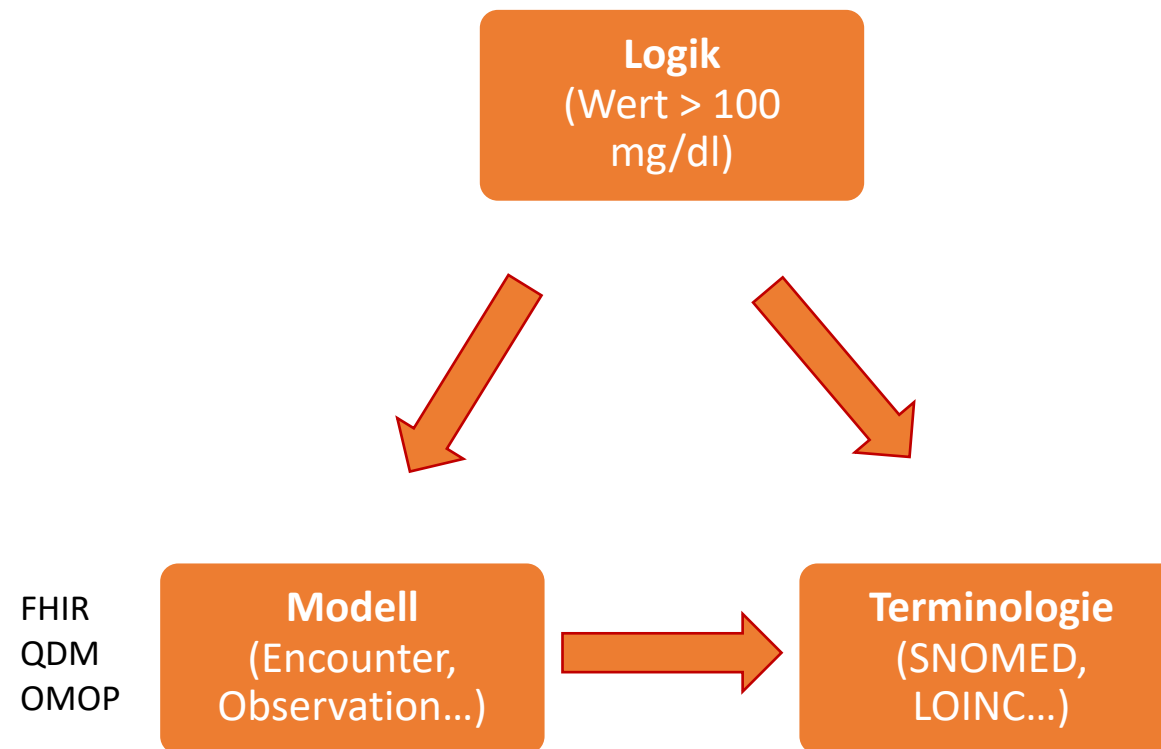
# Diagramm: Ökosystem der Qualitätsverbesserung

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# Clinical Quality Language (CQL)





# CQL Specification



[Documentation](#) [Author's Guide](#) [Developer's Guide](#) [CQL Reference](#) [Grammar](#) [ELM](#) [Examples](#) [Tests](#) [Downloads](#) [Version History](#)

This page is part of the Clinical Quality Language Specification (v1.5.2: [Normative - Normative](#)) based on [FHIR R4](#). This is the current published version. For a full list of available versions, see the [Directory of published versions](#) [↗](#)

<a href="#">Clinical Decision Support</a> Work Group	Maturity Level: N	Standards Status: Normative
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## Clinical Quality Language (CQL)

**HL7 Standard: Clinical Quality Language Specification, Release 1 Mixed Normative/Trial-Use (CQL 1.5)**

### HL7 Mixed Normative/STU Specification

Clinical Quality Language (CQL) is a high-level, domain-specific language focused on clinical quality and targeted at measure and decision support artifact authors.

In addition, this specification describes a machine-readable canonical representation called Expression Logical Model (ELM) targeted at implementations and designed to enable sharing of clinical knowledge.



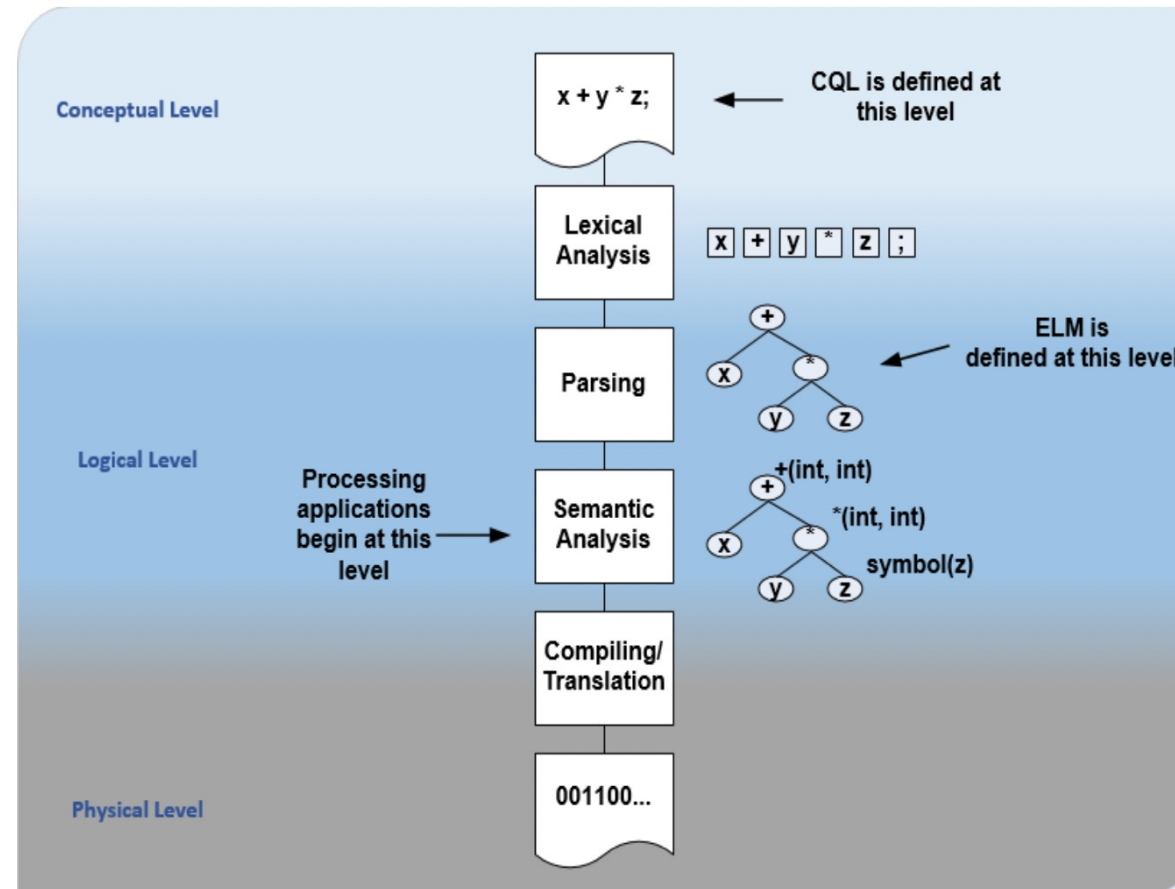


# CQL Specification

- **Author's Guide:** Einführung in CQL für Clinical Quality Authors
- **Developer's Guide:** Tiefere Einsicht für die Zielgruppe Entwickler, die mit Programmiersprachen vertraut sind
- **CQL Reference:** Vollständige Referenz für alle Operators und Functions in CQL



# CQL Architektur: CQL $\rightarrow$ ELM





# CQL Architektur: CQL → ELM

```
library ExampleCQLBasic
using FHIR version '4.0.1'
context Patient
define "Initial Population":
    AgeInYears() >= 60
```

```
<def name="Initial Population" context="Patient"
accessLevel="Public">
  <expression xsi:type="GreaterOrEqual">
    <operand precision="Year" xsi:type="CalculateAge">
      <operand path="birthDate.value" xsi:type="Property">
        <source name="Patient" xsi:type="ExpressionRef"/>
      </operand>
    </operand>
    <operand valueType="t:Integer" value="60" xsi:type="Literal"/>
  </expression>
</def>
```

Stellt die nötige Semantik bereit, um die richtigen Daten abzufufen.





# CQL Syntax: Library

```
1  library FirstExample version '0.1.0'
2
3  using FHIR version '4.0.1'
4
5  include FHIRHelpers version '4.0.1'
6
7  valueset "Marital Status": 'http://hl7.org/fhir/ValueSet/marital-status'
8
9  context Patient
10
11  define PatientExample:
12    Patient P
13      where P.gender = 'male'
14          and P.active is true
15          and P.birthDate 30 years before Today()
16          and not(P.deceased)
17          and P.maritalStatus in "Marital Status"
```

Beispiel von <https://github.com/cqframework/sample-content-ig>



# CQL Syntax: Library

```
1 library FirstExample version '0.1.0' ← CQL Library Deklaration (Name "FirstExample", Version 0.1.0)
2
3 using FHIR version '4.0.1' ← Datenmodell (FHIR 4.0.1)
4
5 include FHIRHelpers version '4.0.1' ← Dependencies (weitere CQL Library namens "FHIRHelpers" in Version 4.0.1)
6
7 valueset "Marital Status": 'http://hl7.org/fhir/ValueSet/marital-status' ← Relevante Terminologie
8
9 context Patient ← Context
10
11 define PatientExample:
12     Patient P ← Definitionen
13     where P.gender = 'male'
14     and P.active is true
15     and P.birthDate 30 years before Today()
16     and not(P.deceased)
17     and P.maritalStatus in "Marital Status"
```



# CQL Syntax: Retrieve

Beispiel von <https://github.com/cqframework/sample-content-ig>

```
6
7 codesystem "LOINC": 'http://loinc.org'
8
9 valueset "Lung Cancer": 'http://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113762.1.4.1116.89'
10 valueset "Condition Clinical Status": 'http://utah.edu/fhir/lcs-cds/ValueSet/conditionclinical'
11
12 code "Tobacco Smoking Status": '72166-2' from "LOINC"
13
14 context Patient
15
16 define "Smoking status observation":
17     [Observation: "Tobacco Smoking Status"] O
18     where O.status in { 'final', 'amended' }
19
20 define "Lung cancer diagnosis":
21     [Condition: "Lung Cancer"] C
22     where C.clinicalStatus in "Condition Clinical Status"
```



# CQL Syntax: Retrieve

## Retrieve by Code (Tobacco Smoking Status)

```
6
7 codesystem "LOINC": 'http://loinc.org'
8
9 valueset "Lung Cancer": 'http://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113762.1.4.1116.89'
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11
12 code "Tobacco Smoking Status": '72166-2' from "LOINC"
13
14 context Patient
15
16 define "Smoking status observation":
17   [Observation: "Tobacco Smoking Status" 0 ←
18     where O.status in { 'final', 'amended' }
19
20 define "Lung cancer diagnosis":
21   [Condition: "Lung Cancer"] C
22   where C.clinicalStatus in "Condition Clinical Status"
```

wie  
GET [base]/Observation?  
code=72166-2



# CQL Syntax: Retrieve

## Retrieve by Code (Tobacco Smoking Status)

```
6
7 codesystem "LOINC": 'http://loinc.org'
8
9 valueset "Lung Cancer": 'http://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113762.1.4.1116.89'
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11
12 code "Tobacco Smoking Status": '72166-2' from "LOINC"
13
14 context Patient
15
16 define "Smoking status observation":
17   [Observation: "Tobacco Smoking Status" 0 ←
18     where O.status in { 'final', 'amended' }
19
20 define "Lung cancer diagnosis":
21   [Condition: "Lung Cancer"] C
22   where C.clinicalStatus in "Condition Clinical Status"
```

Genauer: wie  
**GET [base]/Observation  
?subject=Patient/123  
&code=72166-2**



# CQL Syntax: Retrieve

## Retrieve by ValueSet: Condition Clinical Status

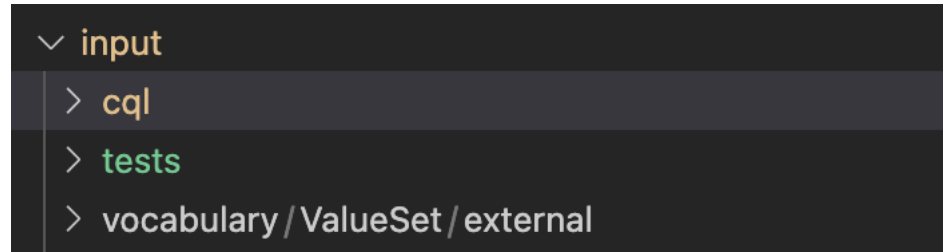
```
6
7 codesystem "LOINC": 'http://loinc.org'
8
9 valueset "Lung Cancer": 'http://cts.nlm.nih.gov/fhir/ValueSet/2.16.840.1.113762.1.4.1116.89'
10 valueset "Condition Clinical Status": 'http://utah.edu/fhir/lcs-cds/ValueSet/conditionclinical'
11
12 code "Tobacco Smoking Status": '72166-2' from "LOINC"
13
14 context Patient
15
16 define "Smoking status observation":
17   [Observation: "Tobacco Smoking Status"] O
18   where O.status in { 'final', 'amended' }
19
20 define "Lung cancer diagnosis":
21   [Condition: "Lung Cancer"] C
22   where C.clinicalStatus in "Condition Clinical Status"
```

GET [base]/Condition  
?subject=Patient/123  
&code:in=http://utah.../ValueSet/conditionclinical



# CQL Tools: VS Code mit CQL Plugin

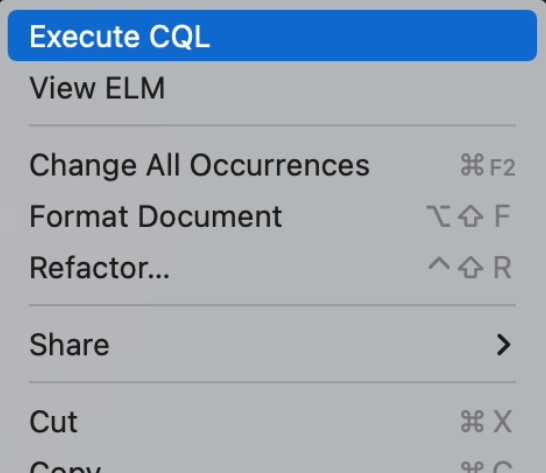
- Vorgegebene Ordner-Struktur:
  - **input/cql** → Dependencies und neu erstellte CQL Library
  - **input/tests** → FHIR Ressourcen die für die Tests herangezogen werden sollen (Ordnername und IDs relevant!)
  - **input/vocabulary** → Terminologie die für die Tests herangezogen werden soll
  - Mehr Details zur Ordnerstruktur: <https://github.com/cqframework/sample-content-ig>
- Rechts-Klick → Execute CQL





# Übung: CQL in VS Code

```
input > cql > FirstExample.cql
1  library FirstExample version '0.1.0'
2
3  using FHIR version '4.0.1'
4
5  include FHIRHelpers version '4.0.1'
6
7  valueset "Marital Status": 'http://hl7.org/fhir/ValueSet/marital-status'
8
9  context Patient
10
11  define PatientMaleOver50:
12    Patient P
13      where P.gender = 'male'
14          and P.active is true
15          and P.birthDate 50 years or more before Today
16          and not(P.deceased)
17          and P.maritalStatus in "Marital Status"
18
19  define PatientFirstName: Patient.name.given.value
```



- Execute CQL
- View ELM
- Change All Occurrences ⌘ F2
- Format Document ⇧ ⇧ F
- Refactor... ^ ⇧ R
- Share >
- Cut ⌘ X
- Copy ⌘ C

Wichtig: Library-Namen innerhalb unserer Gruppe eindeutig wählen (z.B. Nachname als Suffix)





# Details zu Test-Patienten

id	Alter zum 15.09.2022	1. 6-Fach Impfung	2. 6-Fach Impfung	3. 6-Fach Impfung	Numerator
ImmunizationStatus-cut-off-age-group-patient-1	2 Wochen				TRUE
ImmunizationStatus-2-month-patient-1	2 Monate				TRUE
ImmunizationStatus-2-month-patient-2	2 Monate				FALSE
ImmunizationStatus-4-month-patient-1	4 Monate				TRUE
ImmunizationStatus-4-month-patient-1	4 Monate				FALSE
ImmunizationStatus-6-month-patient-1	6 Monate				TRUE
ImmunizationStatus-6-month-patient-2	6 Monate				FALSE
ImmunizationStatus-1-year-patient-1	1 Jahr				TRUE
ImmunizationStatus-1-year-patient-2	1 Jahr				FALSE
ImmunizationStatus-4-year-patient-1	4 Jahre				TRUE
ImmunizationStatus-4-year-patient-2	4 Jahre				FALSE
ImmunizationStatus-4-year-patient-3	4 Jahre				FALSE

Annahme: Auswertung zum 15.09.2022 – Evaluierungs-Ergebnis ändert sich mit der Zeit (Alter der Patienten).



# Fancy CQLs: CMS Immunization Coverage

```
define "MMR Numerator Inclusion Conditions":
  ( ["Diagnosis": "Disorders of the Immune System"]
    union ["Diagnosis": "HIV"]
    union ["Diagnosis": "Malignant Neoplasm of Lymphatic and Hematopoietic Tissue"]
    union ["Diagnosis": "Neomycin adverse reaction (disorder)"] ) MMRConditions
  where ( start of MMRConditions.prevalencePeriod during Interval[Patient.birthDatetime, "Date of Second Birthday"] )

define "Numerator":
  ( exists ( "Four DTaP Vaccinations" )
    or exists ( "DTaP Numerator Inclusion Conditions" )
  )
  and ( exists ( "Three Polio Vaccinations" )
    or exists ( "Polio Numerator Inclusion Conditions" )
  )
  and ( exists ( "One MMR Vaccination" )
    or exists ( "MMR Numerator Inclusion Conditions" )
    or ( exists ( "Measles Indicators" )
      and exists ( "Mumps Indicators" )
      and exists ( "Rubella Indicators" )
    )
  )
  )
  and ( "Has Appropriate Number of Hib Immunizations"
    or exists ( "Hib Numerator Inclusion Conditions" )
  )
```



# Fancy CQLs: CMS Breast Cancer Screening

```
define "MMR Numerator Inclusion Conditions":
  ( ["Diagnosis": "Disorders of the Immune System"]
    union ["Diagnosis": "HIV"]
    union ["Diagnosis": "Malignant Neoplasm of Lymphatic and Hematopoietic Tissue"]
    union ["Diagnosis": "Neomycin adverse reaction (disorder)"] ) MMRConditions
  where ( start of MMRConditions.prevalencePeriod during Interval[Patient.birthDatetime, "Date of Second Birthday"] )

define "Numerator":
  ( exists ( "Four DTaP Vaccinations" )
    or exists ( "DTaP Numerator Inclusion Conditions" )
  )
  and ( exists ( "Three Polio Vaccinations" )
    or exists ( "Polio Numerator Inclusion Conditions" )
  )
  and ( exists ( "One MMR Vaccination" )
    or exists ( "MMR Numerator Inclusion Conditions" )
    or ( exists ( "Measles Indicators" )
      and exists ( "Mumps Indicators" )
      and exists ( "Rubella Indicators" )
    )
  )
  and ( "Has Appropriate Number of Hib Immunizations"
    or exists ( "Hib Numerator Inclusion Conditions" )
  )
```



# CQL Tools: Operation \$cql

- Operation Definition: <http://build.fhir.org/ig/HL7/cqf-recommendations/OperationDefinition-cpg-cql.html>
- Implementiert in CQF-Ruler: <https://github.com/cqframework/cqf-ruler>

URL: [base]/\$cql

Parameters

Use	Name	Cardinality	Type	Binding	Documentation
IN	subject	0..1	string (reference)		Subject for which the expression will be evaluated. This corresponds to the context in which the expression will be evaluated and is represented as a relative FHIR id (e.g. Patient/123), which establishes both the context and context value for the evaluation
IN	expression	1..1	string		Expression to be evaluated. Note that this is an expression of CQL, not the text of a library with definition statements.
IN	parameters	0..1	Parameters		Any input parameters for the expression. Parameters defined in this input will be made available by name to the CQL expression. Parameter types are mapped to CQL as specified in the Using CQL section of this implementation guide. If a parameter appears more than once in the input Parameters resource, it is represented with a List in the input CQL. If a parameter has parts, it is represented as a Tuple in the input CQL.



# CQL Tools: Operation \$cql

- Eignet sich gut für erste, kleinere Evaluierungen, bzw. Debugging
- Beispiel: POST [http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/\\$cql](http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/$cql)

```
2  {
3  .. "resourceType": "Parameters",
4  .. "parameter": [
5  ... {
6  ... .. "name": "content",
7  ... .. "valueString": "library LibraryOne\n\nusing FHIR version '4.0.1'\n\ncontext Patient\n\ndefine myDefinitionOfPatientFistName:\n    Patient.name.given\n8  ... },
9  ... {
10 ... .. "name": "subject",
11 ... .. "valueString": "ImmunizationStatus-1-year-patient-1"
12 ... }
13 .. ]
14 }
```



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Was sind Electronic Health Quality Measures?



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Beispiel: Impfplan Österreich



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FHIR: Test-Daten und Terminologie



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Kaffeepause



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CQL: Logik-Definitionen



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**Wie kommt alles zusammen?**



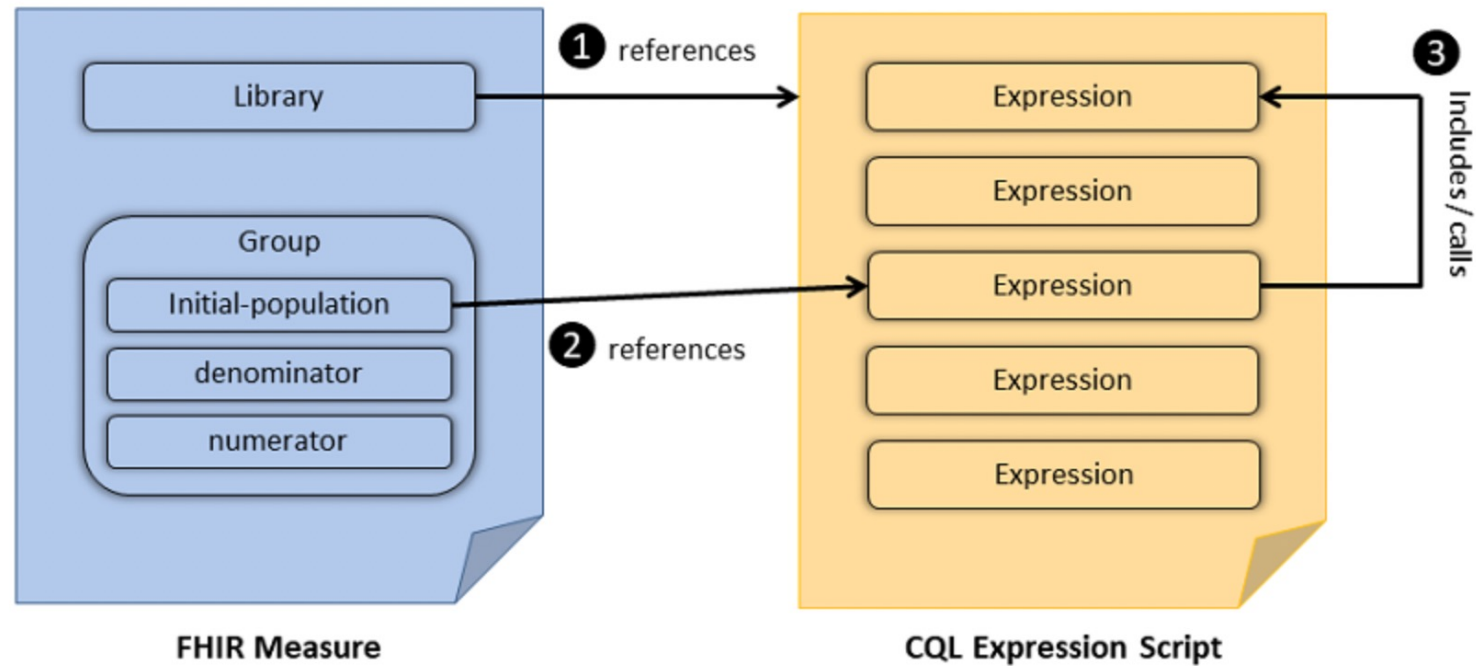
---

Was ist das Result?





# Beziehung FHIR Measure und CQL Script





# FHIR Library und CQL Script

## FHIR Library Resource

```
1 library FirstExample version '0.1.0'
2
3 using FHIR version '4.0.1'
4
5 include FHIRHelpers version '4.0.1'
6
7 valueset "Marital Status": 'http://hl7.org/fhir/ValueSet/marital-sta
8
9 context Patient
10
11 define PatientExample:
12   Patient P
13     where P.gender = 'male'
14     and P.active is true
15     and P.birthDate 30 years before Today()
16     and not(P.deceased)
17     and P.maritalStatus in "Marital Status"
```

```
1 {
2   "resourceType" : "Library",
3   "id": "first-example",
4   "url" : "http://somewhere.org/fhir/uv/mycontentig/Library FirstExample"
5   "version" : '0.1.0',
6   "name": 'FirstExample',
7   "title": "First Example",
8   "status" : "draft",
9   "experimental": true,
10  "type" : {
11    "coding" : [{
12      "system" : "http://terminology.hl7.org/CodeSystem/library-type",
13      "code" : "logic-library"
14    }]
15  },
16  "subjectCodeableConcept": {
17    "coding": [{
18      "system": "hl7.org/fhir/resource-types",
19      "code": "Patient"
20    }]
21  },
22  "description": "Example library illustrating basic CQL constructs",
```





# Übung: Erstellung FHIR Library

- Tool: <https://www.base64encode.org/>
- Library Resource: <https://www.hl7.org/fhir/library.html>
- Das Base64-Encoded CQL Script wird zum *text/cql* content der neuen FHIR Library.
- Library Version, Name und URL-Ende müssen mit CQL Library übereinstimmen
- Fertige Resource kann mit Rest-Tool hochgeladen werden:
  - POST <http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Library>

# Übung: Erstellung FHIR Measure

- Measure Resource: <https://www.hl7.org/fhir/measure.html>
- Fertige Resource kann mit Rest-Tool hochgeladen werden:
  - POST <http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Measure/>
- Library als Referenz
- Proportion scoring
  - <https://www.hl7.org/fhir/valueset-measure-scoring.html>
- 3 Populations in group: Initial Population, Denominator, Numerator
  - <https://www.hl7.org/fhir/valueset-measure-population.html>

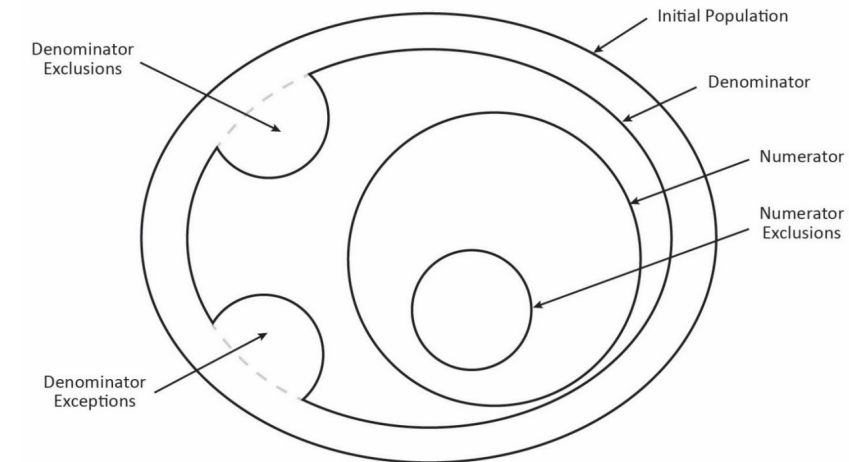


Figure 1. Proportion Measure Populations



# Übung: Operation \$evaluate-measure

- GET [http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Measure/YourMeasure/\\$evaluate-measure?periodStart=2022-09-15&periodEnd=2022-09-15](http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Measure/YourMeasure/$evaluate-measure?periodStart=2022-09-15&periodEnd=2022-09-15)
- Url-Parameter für MeasurementPeriod
- Test-Daten laufen ab → Problem mit Elementen die ein Datum haben





# Parameter \$evaluate-measure

URL: [base]/Measure/\$evaluate-measure

URL: [base]/Measure/[id]/\$evaluate-measure

This is an idempotent operation

In Parameters:					
Name	Cardinality	Type	Binding	Profile	Documentation
periodStart	1..1	date			The start of the measurement period. In keeping with the semantics of the date parameter used in the FHIR search operation, the period will start at the beginning of the period implied by the supplied timestamp. E.g. a value of 2014 would set the period start to be 2014-01-01T00:00:00 inclusive
periodEnd	1..1	date			The end of the measurement period. The period will end at the end of the period implied by the supplied timestamp. E.g. a value of 2014 would set the period end to be 2014-12-31T23:59:59 inclusive
measure	0..1	string (reference)			The measure to evaluate. This parameter is only required when the operation is invoked on the resource type, it is not used when invoking the operation on a Measure instance
reportType	0..1	code			The type of measure report: subject, subject-list, or population. If not specified, a default value of subject will be used if the subject parameter is supplied, otherwise, population will be used
subject	0..1	string (reference)			Subject for which the measure will be calculated. If not specified, the measure will be calculated for all subjects that meet the requirements of the measure. If specified, the measure will only be calculated for the referenced subject(s)
practitioner	0..1	string (reference)			Practitioner for which the measure will be calculated. If specified, the measure will be calculated only for subjects that have a primary relationship to the identified practitioner
lastReceivedOn	0..1	dateTime			The date the results of this measure were last received. This parameter is only valid for patient-level reports and is used to indicate when the last time a result for this patient was received. This information can be used to limit the set of resources returned for a patient-level report



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Was sind Electronic Health Quality Measures?



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Beispiel: Impfplan Österreich



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Kaffeepause



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CQL: Logik-Definitionen



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Wie kommt alles zusammen?



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**Was ist das Result?**





# FHIR MeasureReport

- <https://www.hl7.org/fhir/measurereport.html>
- Je nach *ReportType*:
  - *Population*: MeasureScore zw. 0 und 1 und Anzahl der Patienten je Population
  - *Subject*: MeasureScore mit 0 oder 1
  - *Subject-list*: MeasureScore und Liste der qualifizierenden Patienten je Population



# Übung: \$evaluate-measure mit *reportType*

- [http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Measure/YourMeasure/\\$evaluate-measure?periodStart=2022-09-15&periodEnd=2022-09-15&reportType=subject-list](http://cql-sandbox.projekte.fh-hagenberg.at:8080/fhir/Measure/YourMeasure/$evaluate-measure?periodStart=2022-09-15&periodEnd=2022-09-15&reportType=subject-list)



# Was ist mit dem Cut-Off-Patienten?

id	Alter zum 15.09.2022	1. 6-Fach Impfung	2. 6-Fach Impfung	3. 6-Fach Impfung	Numerator
ImmunizationStatus-cut-off-age-group-patient-1	2 Wochen	🚫	🚫	🚫	TRUE
ImmunizationStatus-2-month-patient-1	2 Monate	✅	🚫	🚫	TRUE
ImmunizationStatus-2-month-patient-2	2 Monate	❌	🚫	🚫	FALSE
ImmunizationStatus-4-month-patient-1	4 Monate	✅	🚫	🚫	TRUE

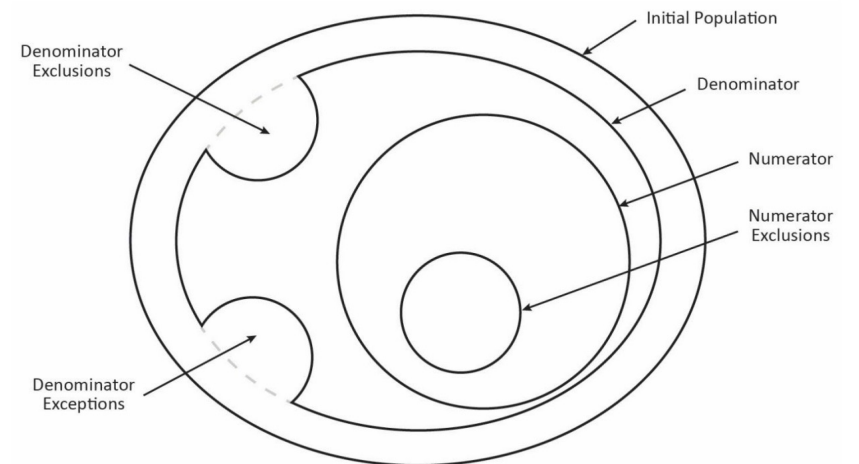


Figure 1. Proportion Measure Populations





# Fragen, Feedback & Anregungen

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