[1]-- The extraction of comorbidities is based on the official visualization view "charlson" of the MIMIC database, the code is as follows.

------------------------------------------------------------------

-- This query extracts Charlson Comorbidity Index (CCI) based on the

-- recorded ICD-9 and ICD-10 codes.

--

-- Reference for CCI:

-- (1) Charlson ME, Pompei P, Ales KL, MacKenzie CR. (1987) A new method

-- of classifying prognostic comorbidity in longitudinal studies:

-- development and validation.J Chronic Dis; 40(5):373-83.

--

-- (2) Charlson M, Szatrowski TP, Peterson J, Gold J. (1994) Validation

-- of a combined comorbidity index. J Clin Epidemiol; 47(11):1245-51.

--

-- Reference for ICD-9-CM and ICD-10 Coding Algorithms for Charlson

-- Comorbidities:

-- (3) Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for

-- defining Comorbidities in ICD-9-CM and ICD-10 administrative data.

-- Med Care. 2005 Nov; 43(11): 1130-9.

-- ------------------------------------------------------------------

WITH diag AS (

 SELECT

 hadm\_id

 , CASE WHEN icd\_version = 9 THEN icd\_code ELSE NULL END AS icd9\_code

 , CASE WHEN icd\_version = 10 THEN icd\_code ELSE NULL END AS icd10\_code

 FROM `physionet-data.mimiciv\_hosp.diagnoses\_icd`

)

, com AS (

 SELECT

 ad.hadm\_id

 -- Myocardial infarction

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('410', '412')

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('I21', 'I22')

 OR

 SUBSTR(icd10\_code, 1, 4) = 'I252'

 THEN 1

 ELSE 0 END) AS myocardial\_infarct

 -- Congestive heart failure

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) = '428'

 OR

 SUBSTR(

 icd9\_code, 1, 5

 ) IN ('39891', '40201', '40211', '40291', '40401', '40403'

 , '40411', '40413', '40491', '40493')

 OR

 SUBSTR(icd9\_code, 1, 4) BETWEEN '4254' AND '4259'

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('I43', 'I50')

 OR

 SUBSTR(

 icd10\_code, 1, 4

 ) IN ('I099', 'I110', 'I130', 'I132', 'I255', 'I420'

 , 'I425', 'I426', 'I427', 'I428', 'I429', 'P290'

 )

 THEN 1

 ELSE 0 END) AS congestive\_heart\_failure

 -- Peripheral vascular disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('440', '441')

 OR

 SUBSTR(

 icd9\_code, 1, 4

 ) IN ('0930', '4373', '4471', '5571', '5579', 'V434')

 OR

 SUBSTR(icd9\_code, 1, 4) BETWEEN '4431' AND '4439'

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('I70', 'I71')

 OR

 SUBSTR(icd10\_code, 1, 4) IN ('I731', 'I738', 'I739', 'I771', 'I790'

 , 'I792'

 , 'K551'

 , 'K558'

 , 'K559'

 , 'Z958'

 , 'Z959'

 )

 THEN 1

 ELSE 0 END) AS peripheral\_vascular\_disease

 -- Cerebrovascular disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) BETWEEN '430' AND '438'

 OR

 SUBSTR(icd9\_code, 1, 5) = '36234'

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('G45', 'G46')

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'I60' AND 'I69'

 OR

 SUBSTR(icd10\_code, 1, 4) = 'H340'

 THEN 1

 ELSE 0 END) AS cerebrovascular\_disease

 -- Dementia

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) = '290'

 OR

 SUBSTR(icd9\_code, 1, 4) IN ('2941', '3312')

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('F00', 'F01', 'F02', 'F03', 'G30')

 OR

 SUBSTR(icd10\_code, 1, 4) IN ('F051', 'G311')

 THEN 1

 ELSE 0 END) AS dementia

 -- Chronic pulmonary disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) BETWEEN '490' AND '505'

 OR

 SUBSTR(icd9\_code, 1, 4) IN ('4168', '4169', '5064', '5081', '5088')

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'J40' AND 'J47'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'J60' AND 'J67'

 OR

 SUBSTR(icd10\_code, 1, 4) IN ('I278', 'I279', 'J684', 'J701', 'J703')

 THEN 1

 ELSE 0 END) AS chronic\_pulmonary\_disease

 -- Rheumatic disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) = '725'

 OR

 SUBSTR(icd9\_code, 1, 4) IN ('4465', '7100', '7101', '7102', '7103'

 , '7104', '7140', '7141', '7142', '7148'

 )

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('M05', 'M06', 'M32', 'M33', 'M34')

 OR

 SUBSTR(icd10\_code, 1, 4) IN ('M315', 'M351', 'M353', 'M360')

 THEN 1

 ELSE 0 END) AS rheumatic\_disease

 -- Peptic ulcer disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('531', '532', '533', '534')

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('K25', 'K26', 'K27', 'K28')

 THEN 1

 ELSE 0 END) AS peptic\_ulcer\_disease

 -- Mild liver disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('570', '571')

 OR

 SUBSTR(

 icd9\_code, 1, 4

 ) IN ('0706', '0709', '5733', '5734', '5738', '5739', 'V427')

 OR

 SUBSTR(

 icd9\_code, 1, 5

 ) IN ('07022', '07023', '07032', '07033', '07044', '07054')

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('B18', 'K73', 'K74')

 OR

 SUBSTR(

 icd10\_code, 1, 4

 ) IN ('K700', 'K701', 'K702', 'K703', 'K709', 'K713'

 , 'K714', 'K715', 'K717', 'K760', 'K762'

 , 'K763', 'K764', 'K768', 'K769', 'Z944')

 THEN 1

 ELSE 0 END) AS mild\_liver\_disease

 -- Diabetes without chronic complication

 , MAX(CASE WHEN

 SUBSTR(

 icd9\_code, 1, 4

 ) IN ('2500', '2501', '2502', '2503', '2508', '2509')

 OR

 SUBSTR(

 icd10\_code, 1, 4

 ) IN ('E100', 'E101', 'E106', 'E108', 'E109', 'E110', 'E111'

 , 'E116'

 , 'E118'

 , 'E119'

 , 'E120'

 , 'E121'

 , 'E126'

 , 'E128'

 , 'E129'

 , 'E130'

 , 'E131'

 , 'E136'

 , 'E138'

 , 'E139'

 , 'E140'

 , 'E141', 'E146', 'E148', 'E149')

 THEN 1

 ELSE 0 END) AS diabetes\_without\_cc

 -- Diabetes with chronic complication

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 4) IN ('2504', '2505', '2506', '2507')

 OR

 SUBSTR(

 icd10\_code, 1, 4

 ) IN ('E102', 'E103', 'E104', 'E105', 'E107', 'E112', 'E113'

 , 'E114'

 , 'E115'

 , 'E117'

 , 'E122'

 , 'E123'

 , 'E124'

 , 'E125'

 , 'E127'

 , 'E132'

 , 'E133'

 , 'E134'

 , 'E135'

 , 'E137'

 , 'E142'

 , 'E143', 'E144', 'E145', 'E147')

 THEN 1

 ELSE 0 END) AS diabetes\_with\_cc

 -- Hemiplegia or paraplegia

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('342', '343')

 OR

 SUBSTR(icd9\_code, 1, 4) IN ('3341', '3440', '3441', '3442'

 , '3443', '3444', '3445', '3446', '3449'

 )

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('G81', 'G82')

 OR

 SUBSTR(icd10\_code, 1, 4) IN ('G041', 'G114', 'G801', 'G802', 'G830'

 , 'G831'

 , 'G832'

 , 'G833'

 , 'G834'

 , 'G839'

 )

 THEN 1

 ELSE 0 END) AS paraplegia

 -- Renal disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('582', '585', '586', 'V56')

 OR

 SUBSTR(icd9\_code, 1, 4) IN ('5880', 'V420', 'V451')

 OR

 SUBSTR(icd9\_code, 1, 4) BETWEEN '5830' AND '5837'

 OR

 SUBSTR(

 icd9\_code, 1, 5

 ) IN (

 '40301'

 , '40311'

 , '40391'

 , '40402'

 , '40403'

 , '40412'

 , '40413'

 , '40492'

 , '40493'

 )

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('N18', 'N19')

 OR

 SUBSTR(icd10\_code, 1, 4) IN ('I120', 'I131', 'N032', 'N033', 'N034'

 , 'N035'

 , 'N036'

 , 'N037'

 , 'N052'

 , 'N053'

 , 'N054'

 , 'N055'

 , 'N056'

 , 'N057'

 , 'N250'

 , 'Z490'

 , 'Z491'

 , 'Z492'

 , 'Z940'

 , 'Z992'

 )

 THEN 1

 ELSE 0 END) AS renal\_disease

 -- Any malignancy, including lymphoma and leukemia,

 -- except malignant neoplasm of skin.

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) BETWEEN '140' AND '172'

 OR

 SUBSTR(icd9\_code, 1, 4) BETWEEN '1740' AND '1958'

 OR

 SUBSTR(icd9\_code, 1, 3) BETWEEN '200' AND '208'

 OR

 SUBSTR(icd9\_code, 1, 4) = '2386'

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('C43', 'C88')

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C00' AND 'C26'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C30' AND 'C34'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C37' AND 'C41'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C45' AND 'C58'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C60' AND 'C76'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C81' AND 'C85'

 OR

 SUBSTR(icd10\_code, 1, 3) BETWEEN 'C90' AND 'C97'

 THEN 1

 ELSE 0 END) AS malignant\_cancer

 -- Moderate or severe liver disease

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 4) IN ('4560', '4561', '4562')

 OR

 SUBSTR(icd9\_code, 1, 4) BETWEEN '5722' AND '5728'

 OR

 SUBSTR(

 icd10\_code, 1, 4

 ) IN ('I850', 'I859', 'I864', 'I982', 'K704', 'K711'

 , 'K721', 'K729', 'K765', 'K766', 'K767')

 THEN 1

 ELSE 0 END) AS severe\_liver\_disease

 -- Metastatic solid tumor

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('196', '197', '198', '199')

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('C77', 'C78', 'C79', 'C80')

 THEN 1

 ELSE 0 END) AS metastatic\_solid\_tumor

 -- AIDS/HIV

 , MAX(CASE WHEN

 SUBSTR(icd9\_code, 1, 3) IN ('042', '043', '044')

 OR

 SUBSTR(icd10\_code, 1, 3) IN ('B20', 'B21', 'B22', 'B24')

 THEN 1

 ELSE 0 END) AS aids

 FROM `physionet-data.mimiciv\_hosp.admissions` ad

 LEFT JOIN diag

 ON ad.hadm\_id = diag.hadm\_id

 GROUP BY ad.hadm\_id

)

, ag AS (

 SELECT

 hadm\_id

 , age

 , CASE WHEN age <= 50 THEN 0

 WHEN age <= 60 THEN 1

 WHEN age <= 70 THEN 2

 WHEN age <= 80 THEN 3

 ELSE 4 END AS age\_score

 FROM `physionet-data.mimiciv\_derived.age`

)

SELECT

 ad.subject\_id

 , ad.hadm\_id

 , ag.age\_score

 , myocardial\_infarct

 , congestive\_heart\_failure

 , peripheral\_vascular\_disease

 , cerebrovascular\_disease

 , dementia

 , chronic\_pulmonary\_disease

 , rheumatic\_disease

 , peptic\_ulcer\_disease

 , mild\_liver\_disease

 , diabetes\_without\_cc

 , diabetes\_with\_cc

 , paraplegia

 , renal\_disease

 , malignant\_cancer

 , severe\_liver\_disease

 , metastatic\_solid\_tumor

 , aids

 -- Calculate the Charlson Comorbidity Score using the original

 -- weights from Charlson, 1987.

 , age\_score

 + myocardial\_infarct + congestive\_heart\_failure

 + peripheral\_vascular\_disease + cerebrovascular\_disease

 + dementia + chronic\_pulmonary\_disease

 + rheumatic\_disease + peptic\_ulcer\_disease

 + GREATEST(mild\_liver\_disease, 3 \* severe\_liver\_disease)

 + GREATEST(2 \* diabetes\_with\_cc, diabetes\_without\_cc)

 + GREATEST(2 \* malignant\_cancer, 6 \* metastatic\_solid\_tumor)

 + 2 \* paraplegia + 2 \* renal\_disease

 + 6 \* aids

 AS charlson\_comorbidity\_index

FROM `physionet-data.mimiciv\_hosp.admissions` ad

LEFT JOIN com

 ON ad.hadm\_id = com.hadm\_id

LEFT JOIN ag

 ON com.hadm\_id = ag.hadm\_id

;

**References:**

[1]. Quan, H., et al., Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Med Care, 2005. 43(11): p. 1130-9.