Development of an EMR-Based audit, to evaluate quality indicators for osteoporosis in primary care: A Population-Based Study Using the Intego Database

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Abstract

Background: Osteoporosis is a common chronic condition that remains underdiagnosed and undertreated in primary care. Electronic medical records (EMRs) offer opportunities for systematic quality assessment. This study evaluated the feasibility of translating evidence-based osteoporosis quality indicators into EMR-extractable queries and assessed the current quality of care in a primary care morbidity registry.

Methods: Thirty-four previously developed quality indicators were translated into structured queries using the Intego primary care database (Flanders, Belgium). Indicators were modified or excluded based on data availability, technical feasibility, and reliability. Data from 127 general practices, including 413 404 patients, were analyzed in January 2026. Descriptive statistics and achievable benchmarks of care (ABC; mean of the top 10% of practices) were calculated.

Results: A substantial proportion of indicators required modification, and several were excluded due to non-extractable data elements (e.g. T-scores, FRAX). Osteoporosis was identified in 9 450 patients (prevalence 2.29%, 95% CI 2.13–2.47). Performance varied widely across indicators, with higher scores for laboratory monitoring (approximately 66–90%) and lower scores for supplementation, lifestyle, and follow-up (approximately 7–62%). ABC consistently exceeded mean performance, indicating clear potential for improvement.

Conclusion: EMR-based assessment of osteoporosis care is feasible but limited by data quality and structure. Variability exists, particularly in non-pharmacological care. An EMR-based osteoporosis monitoring tool based on audit and feedback may support the general practitioner, provided that data registration improves.

Abstract – Samenvatting

Achtergrond: Osteoporose is een veelvoorkomende chronische aandoening die in de eerste lijn vaak ondergediagnosticeerd en onderbehandeld blijft. Elektronische medische dossiers (EMD's) bieden mogelijkheden voor systematische kwaliteitsbeoordeling. Deze studie evalueerde de haalbaarheid van het vertalen van evidence-based kwaliteitsindicatoren voor osteoporose naar EMD-extraheerbare queries en beoordeelde de huidige kwaliteit van ziekteregistratie in de eerste lijn.

Methoden: Vierendertig reeds ontwikkelde kwaliteitsindicatoren werden vertaald naar gestructureerde queries met behulp van de Intego-databank (Vlaanderen, België). Indicatoren werden aangepast of geëxcludeerd op basis van beschikbaarheid, technische haalbaarheid en betrouwbaarheid. Gegevens van 127 huisartsenpraktijken met in totaal 413 404 patiënten, werden geanalyseerd in januari 2026. Beschrijvende statistieken en haalbare benchmarks (achievable benchmarks of care, ABC; gemiddelde van de top 10% van praktijken) werden berekend.

Resultaten: Een aanzienlijk deel van de indicatoren vereiste aanpassing en verschillende werden geëxcludeerd wegens niet-extraheerbare data-elementen (bijv. T-scores, FRAX). Osteoporose werd geïdentificeerd bij 9 450 patiënten (prevalentie 2,29%, 95% CI 2,13–2,47). De prestaties varieerden sterk tussen de indicatoren, met hogere scores voor laboratoriummonitoring (66–90%) en lagere scores voor supplementen, leefstijl en opvolging (7–62%). Haalbare benchmarks lagen consequent hoger dan de gemiddelde prestaties, wat wijst op mogelijkheid tot verbetering in de meeste praktijken.

Conclusie: EMD-gebaseerde evaluatie van osteoporosezorg is haalbaar, maar wordt beperkt door de kwaliteit en structuur van de data. Vooral in niet-farmacologische zorg is variabiliteit zichtbaar. Een EMD-gebaseerde osteoporose monitoring tool gebaseerd op audit en feedback, kan de huisarts ondersteunen, mits verbetering van de datacaptatie.

Introduction

Osteoporosis is a common chronic condition with a significant impact on global health.[1] The prevalence of osteoporosis in the European Union (including Switzerland and the United Kingdom) is represented in *Figure 1*.[2] In 2019, approximately 32 million individuals in the European region were affected by osteoporosis, representing 5.6% of the total population.[2] The risk of developing osteoporosis increases substantially with age. In Belgium, the lifetime risk of osteoporotic fractures is one in three for postmenopausal women and one in five for men over 50 years of age.[3]

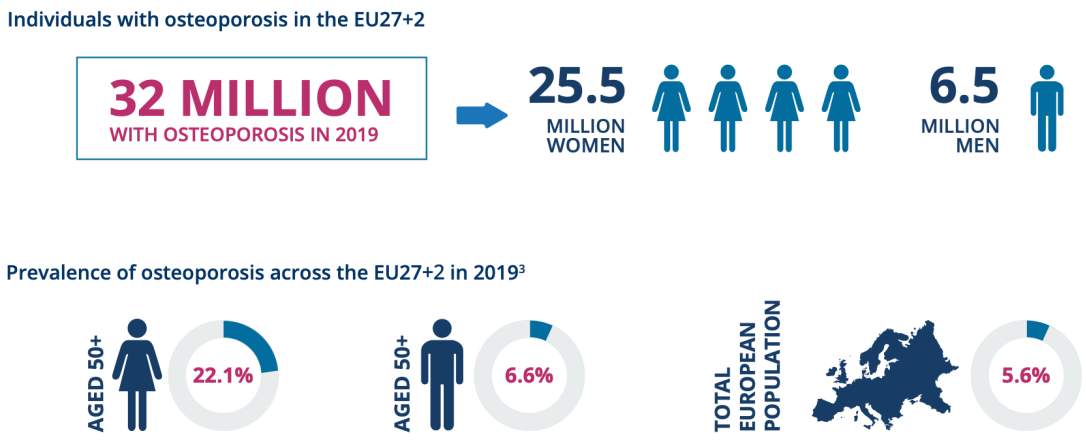


Figure 1: Osteoporosis prevalence in Europe. Figure from the SCOPE 2021 summary report.[2]

This elevated fracture risk is primarily driven by a progressive decline in bone mass and deterioration of bone structure, which can lead to severe complications and a reduced quality of life.[4] Despite the available knowledge of guidelines and treatment options, osteoporosis often remains undiagnosed and undertreated, resulting in preventable health complications.[5–8]

The role of the general practitioner (GP) in the prevention, screening, and treatment of osteoporosis is crucial. Early identification of at-risk patients and targeted interventions can help reduce fracture risk and improve patient outcomes such as quality of life.[9,10] In this context, the electronic medical record (EMR) offers opportunities to structure osteoporosis care and optimize it through data-driven approaches. Systematic evaluation of delivered care may contribute to improved adherence to guidelines, and ultimately better patient outcomes.[11,12]

To support such evaluation, E. Heymans and E. Segaert focused on developing evidence-based and EMR-extractable quality indicators in a previous study.[13] The objective of these indicators is to support GPs in diagnosing and managing osteoporosis within primary care. A total of 34 quality indicators were developed using the RAND-modified Delphi method, covering key aspects of osteoporosis care, including diagnosis, treatment, and follow-up.[14]

Audit and feedback interventions, in which healthcare performance is measured against predefined standards and fed back to clinicians, have been shown to be effective strategies for improving the quality of care in chronic diseases.[15–17] In the Belgian context, similar approaches have already been successfully implemented for conditions such as diabetes and chronic kidney disease, where they have contributed to improved monitoring, guideline adherence, and overall quality of care.[18,19]

However, an important challenge remains in translating theoretical quality indicators into practical, EMR-based measurements. The feasibility of extracting these indicators depends not only on their conceptual design, but also on the availability, structure, and quality of routinely recorded data in clinical practice.[20]

The primary aim of this study is to evaluate the feasibility of translating previously developed osteoporosis quality indicators into structured, EMR-extractable queries within the Integrated Computerized Network (Intego) database.[20] In addition, we aim to assess whether these queries yield reliable and meaningful results that adequately reflect the quality of osteoporosis care in general practice.

A secondary objective is to use these extracted data to describe current practice variation and to establish preliminary benchmarks for osteoporosis care in Flanders. By doing so, this study seeks to explore the potential of a data-driven osteoporosis care barometer, enabling general practitioners to compare their performance with that of peer practices and to identify areas for improvement.

Methods

Ethical approvement

The procedures including the use of Intego in this paper have been approved by the KU Leuven Ethics Committee and by the Belgian Privacy Commission (no. SCSZG/13/079) (*Appendix 1*).

Quality indicators

In a previous study, 34 quality indicators representing good osteoporosis care were established.[13] The different quality indicators can be classified into 7 categories: diagnosis (n=1), screening (n=3), technical investigations (n=2), lifestyle management (n=4), treatment (n=14), follow-up (n=5), and referral (n=5). An overview of the different quality indicators can be found in *Appendix 2*.

Development of queries

Before the quality indicators could be used to extract data from the Intego database, they first had to be translated into structured database queries, enabling precise data retrieval.

Intego is a primary care database in Flanders that collects routinely recorded morbidity data from EMRs to support epidemiological and quality-of-care research.[21] By leveraging data from hundreds of general practitioners across numerous practices, it allows the assessment of osteoporosis management in a real-world primary care setting. The database has been shown to be broadly representative of the Flemish population.[20]

Since 2018, data collection within Intego has been largely automated, with data extracted on a weekly basis from participating GP practices. This allows for up-to-date insights into diagnostic practices, treatment patterns, and follow-up care. The extracted data form the basis for the development of a barometer to evaluate osteoporosis care quality.

Selection of indicators feasible for extraction

In selecting quality indicators for data extraction, it is essential to evaluate data availability, technical feasibility, and data reliability. First, data availability refers to whether the required variables are electronically recorded in the database. Certain elements, such as the timing of a Dual Energy X-ray Absorptiometry (DXA) scan or the documentation of T-scores and Fracture Risk Assessment tool (FRAX) scores, may not be systematically registered in structured electronic fields. In such cases, extraction is not possible.

Second, even when data are available, their extraction may be limited by technical constraints related to database structure or coding practices (e.g. dosing regimen of registered medications).

Finally, data reliability constitutes an additional key consideration. In routine clinical practice, certain parameters are not consistently or systematically recorded in EMRs. This variability in registration may result in biased estimates, potentially leading to under- or overestimation of the actual quality of osteoporosis care.

For the reasons outlined above, not all predefined quality indicators could be included in the data extraction process. *Table 1* provides an overview of the quality indicators that were translated to queries, and a summary of the modifications that were made before translation to queries. The reasons for these changes are explained in more detail in the section below. A complete overview of the queries used for data-extraction can be found in *Appendix 3*. Hereafter, the original quality indicators that were translated into queries will be referred to as QI 1–19. These numbers correspond to the renumbered indicators as presented in *Appendix 3*.

Table 2 presents the quality indicators that were excluded, together with the corresponding reasons for exclusion. More detailed justification for the applied modifications and exclusions is also provided in the sections below.

Table 1: Modifications made to the included quality indicators

Nr.	Indicator before modification	Indicator after modification
1	Percentage of patients with history of a fragility fracture and/or a T-score of -2.5 or lower on 'dual energy X-ray absorptiometry' (DXA) in the lumbar spine (antero-posterior), femoral neck, hip or 1/3 radius who were diagnosed with osteoporosis.	A: Percentage of patients in the clinical practice that are diagnosed with osteoporosis.
		B: Percentage of patients who are receiving pharmacological osteoporosis treatment that are diagnosed with osteoporosis.
5	The percentage of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: - Complete formula - Creatinine - Serum calcium - Phosphate - 25-OH vitamin D - Total protein - Albumin - TSH - Alkaline phosphatases - Ferritin, Fe and transferrin	A: Percentage of patients with osteoporosis in whom white blood cell count was tested once after the diagnosis.
		B: Percentage of patients with osteoporosis in whom red blood cell count was tested once after the diagnosis.
		C: Percentage of patients with osteoporosis in whom platelet count was tested once after the diagnosis.
		D: Percentage of patients with osteoporosis in whom hemoglobin was tested once after the diagnosis.
		E: Percentage of patients with osteoporosis in whom hematocrit was tested once after the diagnosis.
		F: Percentage of patients with osteoporosis in whom MCV was tested once after the diagnosis.
		G: Percentage of patients with osteoporosis in whom MCH was tested once after the diagnosis.
		H: Percentage of patients with osteoporosis in whom MCHC was tested once after the diagnosis.
		I: Percentage of patients with osteoporosis in whom neutrophiles was tested once after the diagnosis.
		J: Percentage of patients with osteoporosis in whom neutrophiles absolute was tested once after the diagnosis.
		K: Percentage of patients with osteoporosis in whom lymphocytes was tested once after the diagnosis.
		L: Percentage of patients with osteoporosis in whom lymphocytes absolute was tested once after the diagnosis.
		M: Percentage of patients with osteoporosis in whom creatinine was tested once after the diagnosis.
		N: Percentage of patients with osteoporosis in whom serum calcium was tested once after the diagnosis.
		O: Percentage of patients with osteoporosis in whom phosphate was tested once after the diagnosis.

		P: Percentage of patients with osteoporosis in whom 25- OH-vitamin D was tested once after the diagnosis.
		Q: Percentage of patients with osteoporosis in whom total protein was tested once after the diagnosis.
		R: Percentage of patients with osteoporosis in whom albumin was tested once after the diagnosis.
		S: Percentage of patients with osteoporosis in whom alkaline was tested once after the diagnosis.
		T: Percentage of patients with osteoporosis in whom ferritin was tested once after the diagnosis.
		U: Percentage of patients with osteoporosis in whom FE was tested once after the diagnosis.
		V: Percentage of patients with osteoporosis in whom transferrin was tested once after the diagnosis.
7	The percentage of patients with osteoporosis who were advised to stop smoking.	The percentage of smoking patients with osteoporosis with a registration of smoking status during the past 2 years.
8	The percentage of patients with osteoporosis who were advised to limit alcohol use to ≤ 2 units per day.	The percentage of patients with osteoporosis who were asked how often they drink alcohol in the last 2 years.
9	The percentage of patients who either had a fracture or fall ≥1/ year who were referred for physiotherapy (fall prevention and rehabilitation).	The percentage of patients who either had a fracture or fall ≥1/ year who were referred for physiotherapy (fall prevention and rehabilitation) less than 3 months after the fracture or fall.
11	Percentage of patients with osteoporosis who take 800-1.000 IU vitamin D per day.	Percentage of patients with osteoporosis who take vitamin D supplementation.
12	Percentage of patients > 50 years with vitamin D deficit < 30ng AND a clinical risk factor for osteoporosis or current smokers who take 800-1000 IU vitamin D per day.	A: Percentage of patients > 50 years with vitamin D deficit < 30ng AND a clinical risk factor for osteoporosis who take vitamin D supplementation.
		B: Percentage of patients > 50 years with vitamin D deficit < 30ng AND current smokers who take vitamin D supplementation.
13	Percentage of patients > 65 years with a clinical risk factor for osteoporosis or current smokers who take 800-1000 IU vitamin D per day.	A: Percentage of patients > 65 years with a clinical risk factor for osteoporosis who take vitamin D supplementation.
		B: Percentage of patients > 65 years AND current smokers who take vitamin D supplementation.

14	Percentage of patients with osteoporosis who have calcium intake of 1200 mg/day or ≥ 4 diary portions a day.	Percentage of patients with osteoporosis who have calcium intake in the form of medication.
15	Percentage of postmenopausal women and patients over 50 years old who had a major osteoporotic fracture in the past 2 years receiving pharmacological osteoporosis treatment now or have received treatment in the past.	A: Percentage of premature menopausal women who had a major osteoporotic fracture in the past 2 years receiving pharmacological osteoporosis treatment now or have received treatment in the past.
		B: Percentage of patients over 50 years old who had a major osteoporotic fracture in the past 2 years receiving pharmacological osteoporosis treatment now or have received treatment in the past.
20	Percentage of osteoporosis patients with gastrointestinal contra-indications and eGFR ≥ 35 ml/min receiving intravenous bisphosphonates once every year for three years.	Percentage of osteoporosis patients with gastrointestinal contra-indications and eGFR ≥ 35 ml/min receiving intravenous bisphosphonates.
21	Percentage of osteoporosis patients with eGFR < 35 ml/min receiving subcutaneous Denosumab every six months as first line treatment.	Percentage of osteoporosis patients with eGFR < 35 ml/min receiving subcutaneous Denosumab.
22	Percentage of osteoporosis patients treated with Zoledronate after a hip fracture.	Percentage of osteoporosis patients treated with Zoledronate within two years after a hip fracture.
23	Percentage of osteoporosis patients receiving Denosumab in whom their serum calcium levels were checked 2 weeks prior treatment during the first year of treatment.	Percentage of osteoporosis patients receiving Denosumab in whom their serum calcium levels were checked.
25	Percentage of osteoporosis patients who had annual check-ups with measurements of height and weight, control of compliance, checking for fractures or fall incidents and assessment of risk factors.	Percentage of osteoporosis patients who had check-ups with measurements of height (ever) and weight (in the last year).
26	Percentage of osteoporosis patients taking bisphosphonates who had annual check of creatinine, calcium and vitamin D.	Percentage of osteoporosis patients taking bisphosphonates who had a check of creatinine, calcium and vitamin D, within the last year.

Table 2: Excluded quality indicators

Nr.	Indicator description	Reason for exclusion
2	Percentage of patients under the age of 50 with one or more clinical risk factor who were screened for osteoporosis by calculating FRAX every 2 years	Technically impossible extraction – Frax Score
3	Percentage of postmenopausal women or men ≥ 50 years of age with - one or more clinical risk factor for fragility fracture or/and - current smoking or/and - age > 65 years who were screened for osteoporosis by calculating the FRAX score every 2 years	Technically impossible extraction – Frax Score
4	The percentage of patients with risk factors for developing secondary osteoporosis i.e.: - Rheumatoid arthritis, Crohn's disease, ulcerative colitis, - Hypercortisolemia (Cushing's syndrome), hyperthyroidism, hyperparathyroidism, hyperprolactinemia, - Early menopause - Male hypogonadism, diabetes mellitus type I and II, - Chronic liver disease, gastrointestinal resection or bypass, celiac disease, malabsorption, lactose intolerance, - Alcoholism, anorexia nervosa, calcium deficiency, vitamin D deficiency, - eGFR <60 ml/ min/1.73 m2, - Glucocorticoids, aromatase inhibitors, gonadotropin-releasing hormone agonists, Tamoxifen, chemotherapy, - Paraplegia, quadriplegia, - Asthma, chronic obstructive pulmonary disease, - Parkinson's disease, multiple sclerosis, stroke, who were screened for osteoporosis by calculating the FRAX score every 2 years.	Technically impossible extraction – Frax Score

6	The percentage of patients with - A history of fragility fracture or/and - Two or more risk factors: one or more clinical risk factors, age > 65 years or active smoking; or/and - Treatment with aromatase inhibitors, antiandrogens for 3 months or longer (both current, prior and cumulative use) who had a DXA.	Technically impossible extraction – DXA-scan
10	The percentage of patients with osteoporosis who were advised to engage in physical activity.	Unreliable information – bad registration of referral behavior
16	Percentage of patients with FRAX 10-year probability of major osteoporotic fracture ≥20% or a 10-year probability of a hip fracture of ≥3% or ≥5% for patients aged ≥70 years who receive pharmacological osteoporosis treatment.	Technically impossible extraction – Frax Score
17	Percentage of patients with T-scores ≤ - 2.5 at the lumbar spine, femoral neck or total hip region receiving pharmacological osteoporosis treatment.	Technically impossible extraction – T-Score
18	Percentage of patients with osteoporosis with: - No fragility fracture in the last 2 years - T-score ≤ -2,5 and > -3.5 - FRAX risk of major osteoporotic fracture ≥ 20% and <30%, or hip fracture ≥ 3% and <4.5% receiving oral bisphosphonates during 5 years as first line therapy if not contraindicated and well tolerated.	Technically impossible extraction – T-Score and Frax-score
24	Percentage of osteoporosis patients with eGFR < 35 ml/min receiving Denosumab in whom their serum calcium levels were checked 2 weeks prior and 2 weeks after treatment during the first year of treatment.	Technically impossible – different time moment registrations in one patient
27	Percentage of osteoporosis patients taking zoledronate for 3 years or alendronate for 5 years with a risk factor i.e. - age >75 years or/and - history of hip or vertebral fracture or/and - one or more fractures due to minimal trauma during treatment current treatment with oral glucocorticoids ≥5mg prednisolone daily or equivalent in whom zoledronate is continued for an additional 3 or 5 years respectively.	Technically impossible – different time moment registrations in one patient

28	Percentage of osteoporosis patients with T- score higher than -2.5 after taking zoledronate for 3 years/ alendronate for 5 years in whom treatment is discontinued.	Technically impossible extraction – T-Score
29	Percentage of osteoporosis patients in whom bisphosphonates are discontinued after 3-5 years who receive a control BMD after 2 years or in case of new fragility fracture.	Technically impossible extraction - DXA
30	Percentage of patients < 50 years with a fragility fracture who are referred to a specialist.	Unreliable information – bad registration of referral behavior
31	Percentage of osteoporosis patients with ≥2 new fractures despite >1 year of treatment with bisphosphonates and good compliance who are referred to a specialist.	Unreliable information – bad registration of referral behavior
32	Percentage of osteoporosis patients with GFR < 15 ml/min/1.73 m2 who are referred to a specialist.	Unreliable information – bad registration of referral behavior
33	Percentage of pre-menopausal women and men < 50 years with a T score <-2,5 who are referred to a specialist.	Unreliable information – bad registration of referral behavior
34	Percentage of osteoporosis patients with: - a fragility fracture in the last 2 years or/and - multiple fragility fractures or/and - a T-score < -3.5 or/and - FRAX risk of major osteoporotic fracture >30%, hip fracture >4.5% who are referred to a specialist.	Unreliable information – bad registration of referral behavior

Reasons for modification or exclusion

Information technically impossible to extract

Certain quality indicators could not be included in the data extraction process because they relied on data elements that are not codable within the EMR. As a result, these elements are not available for extraction from the Intego database, which relies exclusively on coded data entries.

When a non-codable data element was part of a quality indicator, two approaches were considered. If the non-codable component was not essential to the core construct of the indicator, the quality indicator was modified into a revised version excluding the non-codable element. However, if the non-codable data

element was fundamental to the validity or interpretation of the indicator, the quality indicator was excluded in its entirety.

A primary example of a non-codable data element is the DXA scan (dual-energy X-ray absorptiometry). DXA scan results are not registered in a structured, coded format within EMR systems such as CareConnect and are therefore not retrievable as coded variables within the Intego database. Consequently, three quality indicators could not be applied in their original form. Quality indicator (QI)1 was modified to exclude the non-codable component, whereas QI6 and QI29 were excluded entirely.

The second non-codable element was the T-score. As T-scores are not registered in a structured, extractable format within the EMR, QI1 required further modification. In addition, QI17, QI18, and QI28 were excluded, as the T-score constituted an essential component of their operational definition.

Similarly, the FRAX score could not be extracted in the coded form. Because these scores are not systematically integrated as structured variables within the EMR, QI2, QI3, QI4, QI16, and QI18 were excluded. In these indicators, the fracture risk score represented a core criterion and could therefore not be left out without substantially changing the indicator.

A further technical limitation concerned the inability to reliably extract and relate multiple time points within a single patient record in a structured manner. More specifically, it was not technically feasible to define and compare distinct time intervals relative to a specific therapeutic intervention within the same patient (e.g. laboratory measurements before and after treatment initiation). This isn't a limitation of Intego, but on the broader design of the GP barometer, which is intended to be applicable across different EMR systems and therefore cannot rely on more complex temporal data structures.

An example is QI24, which requires assessment of serum calcium levels within a defined time window of two weeks before and two weeks after administration of denosumab. Because such relative time-window analyses cannot be operationalized through structured coding within the GP barometer, this indicator, together with QI27, was excluded. For other indicators in which temporal sequencing was not intrinsic to the core construct, modifications were possible. QI20, QI21, and QI23 were therefore adapted to exclude the temporal requirement while preserving the objective of the indicator.

Furthermore, QI25 included several process-related parameters that could not be extracted in coded form: documentation of treatment adherence, evaluation of fall incidents and assessment of osteoporosis risk factors. As these elements are not coded within the EMR, they could not be used for database queries. We modified QI25 in a way only the codable parameters remained.

Finally, we could not fully extract medication dosages. We can retrieve prescribed medications using the Anatomical Therapeutic Chemical (ATC) classification system. This system helps identify active substances and therapeutic classes. Additionally, the CNK code helps identify the dose of the pharmaceutical product. However, information on posology, such as the prescribed amount and frequency of intake, is often recorded in free-text fields. This information is not consistently structured for extraction, although some partial structured registration might exist.

As a result, we needed to modify the quality indicators that specify the exact dosage. QI11, QI12, and QI13, which included defined daily doses of vitamin D supplementation, were changed to capture the presence of a registered vitamin D supplement based on ATC coding, regardless of the frequency of intake. A similar approach was used for QI14, where only the prescription of a calcium supplement was considered, regardless of the prescribed dosage or regimen.

Unreliable information

Certain variables, such as smoking status, alcohol consumption, referral to physiotherapy, and referral to a specialist, are not always registered in a uniform or structured manner within the EMR. Although these parameters may be documented, their coding is often incomplete, inconsistently updated, or recorded in free-text fields rather than structured data entries. Consequently, direct extraction based strictly on the original definitions of the quality indicators would likely result in underestimation.

To overcome this limitation, selected quality indicators were modified to improve the use of the queries with the original purpose in mind.

QI7, QI8, and QI9 were modified accordingly. For these indicators, adaptation of the temporal criteria allowed capture of relevant documentation even when registration did not strictly conform to the original time constraints.

In contrast, several indicators related to referral to a medical specialist could not be reliably operationalized. Referral decisions are frequently documented in narrative form and are not consistently registered using structured, coded entries. As a result, QI10, QI30, QI31, QI32, QI33, and QI34 were excluded, as their validity depended on reliable identification of specialist referrals within the database.

Modifications to improve the specificity of assessing osteoporosis care

In addition to modifications driven by availability and data reliability constraints, several quality indicators were adapted to allow for a more specific evaluation of the quality of osteoporosis care. The aim of these modifications was to better identify concrete strengths and deficiencies within the care process.

Some original quality indicators were formulated as composite measures, combining multiple clinical components into a single outcome. While informative, such composite indicators may mask which specific aspects of care are adequately implemented and which are not. To enable a more detailed assessment, selected indicators were therefore subdivided into separate sub-indicators, allowing each component to be analyzed independently. QI5, QI12, and QI15 were modified accordingly.

Modification for identification of osteoporosis population

A distinct modification was introduced to enable identification of the osteoporosis population within the participating practices. As previously noted, the original formulation of quality indicator 1 aimed to assess appropriate diagnostic evaluation based on DXA screening in at-risk populations. However, because DXA results are not available as structured, extractable data, this indicator could not be implemented as originally defined.

Instead, a modified approach was developed to identify the existing population of patients with osteoporosis within the practice. The adapted indicator was subdivided into two sub-indicators. The first assessed the number of patients with a registered diagnosis of osteoporosis. The second identified patients currently receiving osteoporosis-specific pharmacological treatment, acknowledging that some treated patients may not have a formally coded diagnosis in their EMR.

This dual approach enabled estimation of the actively recognized osteoporosis population and facilitated comparison with benchmark data, thereby allowing the exploration of potential underdiagnosis within the practice population.

Data extraction from Intego database

Selection of practices

Prior to data extraction from the Intego database, practices were selected based on osteoporosis prevalence and practice size to ensure sufficient data robustness. Osteoporosis prevalence was defined as the proportion of patients with a registered diagnosis of osteoporosis or osteoporosis treatment within each practice. Practices were ranked according to prevalence, and the mean prevalence of the lowest 10% was calculated. Practices with a prevalence below this threshold were excluded.

Practice size was assessed based on the number of registered Global Medical Records (GMDs). Practices with fewer than the mean size of the lowest 10% were excluded.

Selection of quality indicators

An initial set of quality indicators had been defined. Post hoc refinement was performed after data processing. Indicators for which more than 50% of practices had either missing data or extreme scores (0% or 100%) were excluded, to ensure sufficient discriminatory capacity for comparative analysis.

Handling of missing data

Missing data at the practice level was considered on an indicator-by-indicator basis. If a quality indicator could not be calculated for a practice, when a practice had no patients meeting the denominator criteria of a specific indicator, resulting in a non-calculable value, only the corresponding data point was treated as missing. The practice remained in the overall analysis. Summary statistics were calculated using practices with available data for the respective indicator.

Data analysis

For all included quality indicators, practice-level performance scores were extracted from the Intego database. For each indicator, descriptive statistics were calculated, including the mean, standard deviation (SD), standard error (SE), and corresponding 95% confidence interval (CI).

In addition, the achievable benchmark of care (ABC) was determined for each indicator.[22] This benchmark was defined as the mean performance of the top 10% best-performing practices, reflecting an estimate of achievable care under optimal conditions.

Results

Study population and indicator selection

Study population

Data extraction from the Intego database in January 2026 yielded results from 138 general practices. Applying the predefined calculation for osteoporosis prevalence (calculated on a minimum threshold of 0.36%) and practice size (calculated on a minimum threshold of 260 EMRs) resulted in the exclusion of 11 practices, leaving 127 practices included in the final analysis.

Quality indicator selection

Following post hoc evaluation, four indicators (4, 6, 12a, and 12b) were excluded due to a high proportion of missing data or extreme values. The benchmarks and statistics were calculated in the remaining indicators.

Missing data

The number of practices included in the analysis varied across quality indicators due to non-calculable values at the practice level. Out of the 127 practices and 38 quality indicators, 44 indicator values could not be calculated. Missing values that occurred are listed in *Table 3*. Summary statistics for each indicator were calculated using only the practices with available data. A schematic overview can be found in *Table 3*.

Distribution of eligible patient volume

Table 3 provides an overview of the number of eligible patients per indicator. Eligible patients were defined as those meeting the denominator criteria of each query.

A substantial variation in patient numbers across indicators was observed. Indicators with broader inclusion criteria resulted in higher patient counts per practice. Conversely, indicators requiring more specific conditions were associated with smaller patient groups.

Table 3: Included patients (denominator) for each quality indicator

Indicator	Number of patients	Practices with a valid score	Practices without a valid score	SD*	Mean	Median	Range**	IQR***
1a	413 404	127	0	2 069	3 255	2 918	12 379	2 517
1b	9 512	127	0	56	75	62	311	68
2	9 450	127	0	56	74	60	314	69
5	13 095	127	0	75	103	85	430	87
8	13 080	127	0	75	104	86	430	86
9a	13 270	127	0	96	104	77	514	108
9b	10 105	126	1	72	80	69	338	91
10a	16 933	127	0	123	133	104	609	122
10b	7 876	125	2	58	62	45	254	62
11	13 095	127	0	58	62	85	430	87
13	1 721	123	4	13	14	10	81	16
14	1 195	118	9	10	9	6	65	12
15	1 134	117	10	8	9	6	48	9
16	914	111	16	7	7	6	35	8
17	2 999	125	2	22	24	17	116	24
18	12 599	127	0	73	104	88	430	84
19	6 009	127	0	34	47	39	171	37

***SD** = standard deviation; ****Range** = minimum–maximum; *****IQR** = interquartile range (Q1–Q3).

Characteristics of the population

An overview of the characteristics of the included population can be found in *Table 4*. In total, 413 404 patients from 127 general practices were included in the analysis. 211 718 patients were younger than 50 years old, 97 612 were in the age group of 50-65 and 104 074 patients were older than 65 years. Within this population, 9 450 patients were identified as having osteoporosis, corresponding to an overall prevalence of 2.29% (CI: 2.13%-2.47%).

Table 4: Characteristics of the included patient population of the Intego database

CHARACTERISTIC	**N**
Patients in Intego	413 404
Practices in Intego	127
Patients in Integeo 18-50	211 718
Patients in Intego 50-65	97 612
Patients in Intego 65+	104 074
Patients with osteoporosis	9 450

Visualization of quality of care

A heat map was constructed to visualize the performance of the selected practices across all included quality indicators (*Appendix 4).* This representation highlights the variability in performance between practices. Differences in performance are indicated using a color gradient, ranging from lower scores (red) to higher scores (green), allowing easy comparison between practices.

Visualization of benchmarks

Table 5 presents the aggregated performance of all practices for each indicator, expressed as mean values with corresponding standard deviation and 95% confidence intervals. In addition, the best achievable benchmarks were calculated using the ABC method.

For each indicator, the number of practices reaching or exceeding the benchmark is also reported. Indicators with lower overall performance were generally associated with lower benchmark values. For instance, for some indicators the benchmark remained relatively modest, reflecting overall suboptimal performance. In contrast, indicator 17 (the registration of serum calcium within osteoporosis patients treated with denosumab) reached a benchmark of 100%, indicating that the top-performing practices consistently achieved optimal scores.

Table 5: Statistics of the quality indicators

Indicator	Mean (%)	SD* (%)	SE** (%)	95% CI (%) min	95%CI (%) max	ABC™ (%)	Number of practices at or above the ABC™ benchmark
1a	2.296124	0.991003	0.172354	2.12377	2.468478	4.230308	5
1b	60.12775	16.41905	2.855579	57.27217	62.98333	85.44516	5
2a	89.3286	7.875823	1.369753	87.95884	90.69835	98.7385	6
2b	89.31863	7.383239	1.284083	88.03454	90.60271	98.48068	6
2c	87.64963	10.04945	1.747787	85.90184	89.39741	98.7099	6
2d	89.67122	7.306641	1.270761	88.40046	90.94198	98.7385	6
2e	89.23048	7.414698	1.289554	87.94093	90.52004	98.48068	6
2f	89.31862	7.394837	1.2861	88.03252	90.60472	98.48068	6
2g	89.27367	7.395625	1.286237	87.98744	90.55991	98.38822	6
2h	89.19233	7.409176	1.288594	87.90373	90.48092	98.38822	6
2i	42.48684	36.85226	6.409296	36.07754	48.89613	94.11785	5
2j	24.16267	28.90256	5.026694	19.13598	29.18937	85.15805	6
2k	82.33591	14.11974	2.455687	79.88022	84.7916	97.66936	5
2l	70.7013	25.70328	4.470281	66.23102	75.17158	96.49044	5
2m	89.82263	7.338491	1.276301	88.54633	91.09894	98.76004	6
2n	66.12839	15.01987	2.612236	63.51616	68.74063	89.50201	5
2o	48.61883	19.30215	3.357004	45.26183	51.97584	82.38517	5
2p	71.18791	14.94319	2.598899	68.58901	73.78681	91.73986	5
2q	51.03156	20.47607	3.561171	47.47039	54.59273	89.65718	5
2r	37.30052	16.90398	2.939918	34.36061	40.24044	71.87794	5
2s	72.42324	15.91894	2.7686	69.65464	75.19184	95.75963	6
2t	78.54755	12.40748	2.157892	76.38966	80.70544	94.57859	4
2u	65.44163	20.4203	3.551471	61.89016	68.9931	92.10436	4
2v	49.23201	19.88298	3.458021	45.77399	52.69003	85.13205	6
5	8.863025	13.95763	2.427493	6.435532	11.29052	43.21374	7
8	62.2778	11.8282	2.057146	60.22065	64.33494	79.8051	6
9a	44.91833	13.77744	2.396155	42.52217	47.31448	69.56986	5
9b	43.13069	17.77332	3.103355	40.02733	46.23404	76.18535	4
10a	47.04265	13.34735	2.321354	44.7213	49.36401	71.49404	4
10b	41.6624	16.49853	2.892267	38.77013	44.55467	69.84488	3
11	41.88045	14.51711	2.524796	39.35566	44.40525	67.00308	6
13	48.80247	24.63631	4.353826	44.44864	53.15629	87.04907	5
14	15.30079	19.8169	3.575549	11.72524	18.87634	58.14815	5
15	42.2846	23.66409	4.287902	37.99669	46.5725	83.76254	5
16	18.25954	22.82533	4.246231	14.01331	22.50577	70.03968	4
17	84.81089	14.5676	2.553766	82.25713	87.36466	100	26
18	6.790757	8.235091	1.432236	5.358521	8.222994	27.37764	7
19	25.68706	15.03931	2.615617	23.07144	28.30268	56.0274	5

***SD** = standard deviation; ****SE** = standard error.

Discussion

Key messages

This study demonstrates that translating osteoporosis quality indicators into structured EMR-based queries can be done but remains constrained by limitations in data availability and registration practices. Many indicators required modification, and several could not be implemented. This highlights the gap between theoretical quality frameworks and real-world data use.

The results reveal a consistent pattern across domains of care. Indicators related to technical and biomedical processes, such as laboratory monitoring during treatment, showed relatively high performance and limited variability. In contrast, preventive, follow-up and lifestyle management quality indicators performed considerably worse and exhibited greater variability between practices.

This suggests that osteoporosis care in primary care settings is focused on measurable actions while less structured parts of care are less consistently delivered or documented.

The low recorded prevalence of osteoporosis indicates that case identification remains suboptimal, either due to underdiagnosis or incomplete coding of diagnosis. This finding directly affects the denominator of many quality indicators and may lead to an underestimation of care gaps.

The consistent gap between average performance and the achievable benchmarks suggests that improvement is attainable within the current healthcare system. However, the extent to which such improvement can be achieved without fundamental structural changes depends on the underlying drivers of the observed variability. Differences in performance may reflect variation in EMR registration practices, the degree of decision support within the EMR, or organizational factors within practices, such as the involvement of practice nurses or structured care pathways. Understanding these determinants is essential, as they will influence which targeted interventions are needed in lower-performing practices to improve care quality.

Comparison to current literature

The findings of this study are consistent with current literature demonstrating that osteoporosis remains both underdiagnosed and undertreated in primary care settings. Previous research has repeatedly shown that a significant proportion of patients at high risk do not receive appropriate pharmacological treatment. This highlights a persistent treatment gap in osteoporosis management. [23–25]

In addition to treatment gaps, adherence to supplementation and follow-up care of osteoporosis has previously been shown to be inconsistent.[26] These findings are in line with our study, where indicators related to supplementation and follow-up care demonstrated lower performance and greater variability across practices.

The observed discrepancy between strong performance in technical aspects of care and weaker performance in preventive or behavioral domains is not unique to osteoporosis. It reflects a trend in chronic disease management. Interventions that are easily measurable, protocol-driven, and embedded within routine clinical workflows tend to achieve higher adherence. This contrasts with interventions that rely more heavily on patient engagement, counseling, or clinical judgment. These interventions are less consistently implemented.[27,28]

Furthermore, the challenges encountered in this study regarding the extraction of quality indicators are the same as the known limitations of research based on electronic medical records. Issues such as incomplete diagnostic coding, variability in documentation practices between clinicians, and the frequent use of non-structured data fields have been widely reported in the literature.[29] These factors complicate the technical process of data extraction and the interpretation of quality of care, as it becomes difficult to distinguish between true gaps in care and gaps in documentation.

In this context, ongoing developments in health data integration may help address some of these limitations. Initiatives such as the Belgian Integrated Health Record (BIHR), together with interoperable standards like FHIR and broader European efforts such as the European Health Data Space (EHDS), aim to improve the structured recording and exchange of health data.[30,31] If key osteoporosis-related variables—such as FRAX scores, T-scores, and DXA results—become routinely available in structured formats, this could substantially enhance the feasibility and clinical relevance of EMR-based quality assessment.

Taken together, these findings confirm that both the clinical and data-related challenges observed in osteoporosis care, are consistent with those reported in the literature. This reinforces the need for both improved guideline implementation as well as better structured data registration in primary care.

Implementation to daily practice

The findings of this study have several important implications for daily clinical practice. First, they show the need to strengthen the non-pharmacological and longitudinal aspects of osteoporosis care. Greater attention should be paid to ensure adequate calcium and vitamin D supplementation, as well as to

implement structured follow-up and promote lifestyle interventions. These components of care are less consistently addressed, despite their well-established role in osteoporosis management.

Second, the variability observed between practices suggests that the implementation of clinical guidelines remains inconsistent. This variability may indicate differences in awareness, prioritization, or integration of osteoporosis care within routine practice. This also implies that osteoporosis is not uniformly managed across all primary care settings.

Third, the proposed osteoporosis barometer represents a potentially valuable tool for audit and feedback in primary care. By enabling benchmarking against peer practices, it can help identify specific gaps in care and support targeted quality improvement initiatives. However, the effectiveness of such a tool will depend critically on the quality, completeness, and level of structure of the underlying EMR data. Without sufficiently robust and consistently recorded data, the reliability and interpretability of the generated indicators may be compromised.

Implementation to future research

Several important directions for future research emerge from the findings of this study.

A key priority is the improvement of data infrastructure within EMRs. This study clearly shows that the feasibility and reliability of EMR-based quality assessment depend heavily on the availability of structured and consistently recorded data. When information is missing or recorded in free text, it becomes difficult to obtain an accurate picture of the quality of care. Future efforts should focus on improving structured data entry and promoting standardization across EMR systems. This would enable more reliable and comprehensive quality monitoring.

An important limitation encountered in this study was that several clinically relevant quality indicators could not be included due to the absence of specific structured data elements. Essential parameters, such as fracture risk assessments (FRAX scores) and bone mineral density measurements (T-scores), were not available in a structured format. Ensuring that these key variables are systematically recorded in EMRs would significantly expand the range of indicators that can be translated to usable queries. Ultimately, this would allow for a more complete and meaningful evaluation of osteoporosis care in primary care settings.

Strengths

This study is based on a large primary care database, reflecting real-world clinical practice. It provides a systematic approach to translating guideline-based quality indicators into EMR-extractable queries. The use of achievable benchmarks offers a realistic perspective on improvement potential.

Limitations

Several limitations should be considered. First, the study relies on routinely collected EMR data, which are subject to incomplete and inconsistent registration. This introduces uncertainty as to whether observed gaps reflect true deficiencies in care or merely documentation issues. Second, key clinical variables, such as T-scores and fracture risk assessments, were not available in structured form. This required modification or exclusion of several indicators and limits the clinical interpretability of the results. Third, the inability to reliably capture complex temporal relationships within this osteoporosis tool restricts the evaluation of longitudinal care processes. This requires the simplification of certain quality indicators. This and all other reasons for the simplification of certain indicators (such as dosage information) may reduce their specificity and comparability to the original defined indicators for good osteoporosis care.

Conclusion

This study has demonstrated that EMR-based assessment of the quality of care for osteoporosis in primary care is possible, though limited by significant technical and registration-related challenges. There is considerable variability in the quality of care for osteoporosis in primary care, and there is considerable potential for improvement. This study has shown promise for the implementation of an automated audit and feedback monitoring instrument, though its use in clinical practice will depend on improvements in structured data registration.

Conflict of interest

The authors have declared that no competing interests exist.

Financial disclosure

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Appendix

Appendix 1: Ethical approvement

Beslissing Ethisch Comité

Betreffende masterproef "Gebruik van audit- en feedbacksysteem ter beoordeling van de behandeling van osteoporose in de huisartspraktijk (MP033055)

De verstrekte informatie toont aan dat het onderzoek in het kader van de masterproef integraal deel uitmaakt van een studie die reeds werd goedgekeurd door een erkend ethisch comité.

U hoeft bijgevolg geen nieuw dossier in te dienen in het kader van uw masterproef.
Wel dient u het UZ/KU Leuven toe te voegen als nieuw deelnemend centrum aan het huidige dossier indien dit nog niet het geval was. Gelieve u bij het betreffende comité te informeren en u te conformeren aan de daar geldende procedures en hun adviezen te volgen.

Onder voorbehoud van de volledigheid en correctheid van de door u verstrekte gegevens, krijgt u hierbij de goedkeuring om het onderzoek in het kader van de masterproef te starten.

Wij willen u erop attent maken dat u zelf verantwoordelijk blijft voor uw onderzoek. Bovendien doet elke wijziging aan de door u verstrekte gegevens omtrent de onderzoeksopzet elke eerdere goedkeuring vervallen. U dient in dit geval een amendement te maken aan uw huidig dossier bij het comité dat eerder uw dossier goedkeurde.

Appendix 2: Quality indicators

List of QI'S	EHR-extractability
DIAGNOSIS	
1) Percentage of patients with history of a fragility fracture* and/or a T-score of -2.5 or lower on 'dual energy X-ray absorptiometry' (DXA) in the lumbar spine (antero-posterior), femoral neck, hip or 1/3 radius who were diagnosed with osteoporosis	Adjustments EHR necessary
SCREENING	
2) Percentage of patients under the age of 50 with one or more clinical risk factor¥ who were screened for osteoporosis by calculating FRAX (Fracture Risk Assessment Tool) every 2 years	Adjustments EHR necessary
3) Percentage of postmenopausal women or men ≥ 50 years of age with - one or more clinical risk factor¥ for fragility fracture or/and - current smoking or/and- age > 65 years who were screened for osteoporosis by calculating the FRAX score every 2 years	Adjustments EHR necessary
4) The percentage of patients with risk factors for developing secondary osteoporosis i.e.: - Rheumatoid arthritis, Crohn's disease, ulcerative colitis, - Hypercortisolaemia (Cushing's syndrome), hyperthyroidism, hyperparathyroidism, hyperprolactinaemia, - Early menopause** - Male hypogonadism, diabetes mellitus type I and II, - Chronic liver disease, gastrointestinal resection or bypass, celiac disease, malabsorption, lactose intolerance, - Alcoholism, anorexia nervosa, calcium deficiency, vitamin D deficiency, - eGFR < 60 ml/ min/1.73 m2, - Glucocorticoids, aromatase inhibitors, gonadotropin-releasing hormone agonists, Tamoxifen, chemotherapy, - Paraplegia, quadriplegia, - Asthma, chronic obstructive pulmonary disease, - Parkinson's disease, multiple sclerosis, stroke, who were screened for osteoporosis by calculating the FRAX score every 2 years	Adjustments EHR necessary
TECHNICAL INVESTIGATIONS	
5) The percentage of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: - Complete formula - Creatinine - Serum calcium - Phosphate - 25-OH vitamin D - Total protein - Albumin - TSH - Alkaline phosphatases - Ferritin, Fe and transferrin	EHR-extractable at present
6) The percentage of patients with - A history of fragility fracture* or/and - Two or more risk factors: one or more clinical risk factors¥, age > 65 years or active smoking; or/and - A FRAX score for primary fracture ≥ 5% or/and - Treatment with aromatase inhibitors, antiandrogens for 3 months or longer (both current, prior and cumulative use) who had a DXA	Adjustments EHR necessary
LIFESTYLE MANAGEMENT	
7) The percentage of patients with osteoporosis who were advised to stop smoking	EHR-extractable at present
8) The percentage of patients with osteoporosis who were advised to limit alcohol use to ≤ 2 units per day	EHR-extractable at present
9) The percentage of patients who either had a fracture or a fall ≥ 1/ year who were referred for physiotherapy (fall prevention and rehabilitation)	Adjustments EHR necessary
10) The percentage of patients with osteoporosis who were advised to engage in physical activity	EHR-extractable at present
TREATMENT	
11) Percentage of patients with osteoporosis who take 800–1.000 IU vitamin D per day	EHR-extractable at present
12) Percentage of patients > 50 years with vitamin D deficit < 30 ng AND a clinical risk factor¥ for osteoporosis or current smokers who take 800–1000 IU vitamin D per day	EHR-extractable at present

List of QI'S	EHR-extractability
13) Percentage of patients > 65 years with a clinical risk factor¥ for osteoporosis or current smokers who take 800–1000 IU vitamin D per day	EHR-extractable at present
14) Percentage of patients with osteoporosis who have calcium intake of 1200 mg/day or ≥ 4 diary portions a day	Adjustments EHR necessary
15) Percentage of postmenopausal women and patients over 50 years old who had a major osteoporotic fracture$ in the past 2 years receiving pharmacological osteoporosis treatment now or have received treatment in the past	Adjustments EHR necessary
16) Percentage of patients with FRAX 10-year probability of major osteoporotic fracture$ ≥ 20% or a 10-year probability of a hip fracture of ≥ 3% or ≥ 5% for patients aged ≥ 70 years who receive pharmacological osteoporosis treatment	Adjustments EHR necessary
17) Percentage of patients with T-scores ≤—2.5 at the lumbar spine, femoral neck or total hip region receiving pharmacological osteoporosis treatment	Adjustments EHR necessary
18) Percentage of patients with osteoporosis with: - No fragility fracture* in the last 2 years or/and - T-score ≤ -2,5 and > -3.5 or/and - FRAX risk of major osteoporotic fracture$ ≥ 20% and < 30%, or hip fracture ≥ 3% and < 4.5% receiving oral bisphosphonates during 5 years as first line therapy if not contraindicated and well tolerated	Adjustments EHR necessary
19) Percentage of osteoporosis patients with one or more of the following: -Barrett esophagus, -Esophageal abnormalities, -Gastric ulcers, -Gastric bypass, -Severe GERD, -Malabsorption -Chronic renal insufficiency eGFR < 35 ml/min who do not receive oral bisphosphonates	EHR-extractable at present
20) Percentage of osteoporosis patients with - Gastrointestinal contra-indications and - eGFR ≥ 35 ml/min and - No fragility fracture* in the last 2 years and/or - T-score ≤ -2,5 and > -3.5 and/or - FRAX risk of major osteoporotic fracture$ ≥ 20% and < 30%, or hip fracture ≥ 3% and < 4.5% receiving intravenous bisphosphonates once a year for three years	Adjustments EHR necessary
21) Percentage of osteoporosis patients with - eGFR < 35 ml/min and - No fragility fracture* in the last 2 years or/and - T-score ≤ -2,5 and > -3.5 or/and - FRAX risk of major osteoporotic fracture$ ≥ 20% and < 30%, or hip fracture ≥ 3% and < 4.5% receiving subcutaneous Denosumab every six months as first line treatment	Adjustments EHR necessary
22) Percentage of osteoporosis patients treated with Zoledronate after a hip fracture	EHR-extractable at present
23) Percentage of osteoporosis patients receiving Denosumab in whom their serum calcium levels were checked 2 weeks prior treatment during the first year of treatment	EHR-extractable at present
24) Percentage of osteoporosis patients with eGFR < 35 ml/min receiving Denosumab in whom their serum calcium levels were checked 2 weeks prior and 2 weeks after treatment during the first year of treatment	EHR-extractable at present
FOLLOW-UP	
25) Percentage of osteoporosis patients who had annual check-ups with measurements of height and weight, control of compliance, checking for fractures or fall incidents and assessment of risk factors	Adjustments EHR necessary
26) Percentage of osteoporosis patients taking bisphosphonates who had annual check of creatinine, calcium and vitamin D	EHR-extractable at present
27) Percentage of osteoporosis patients taking zoledronate for 3 years or alendronate for 5 years with a risk factor i.e - T score after 3 years of treatment < -2.5 or/and - age > 75 years or/and - history of hip or vertebral fracture or/and - one or more fractures due to minimal trauma during treatment or/and - current treatment with oral glucocorticoids ≥ 5 mg prednisolone daily or equivalent in whom zoledronate is continued for an additional 3 or 5 years respectively	Adjustments EHR necessary
28) Percentage of osteoporosis patients with T- score higher than -2.5 after taking zoledronate for 3 years/ alendronate for 5 years in which treatment is discontinued	Adjustments EHR necessary

List of QI'S	EHR-extractability
29) Percentage of osteoporosis patients in whom bisphosphonates are discontinued after 3–5 years who receive a control BMD after 2 years or in case of new fragility fracture*	Adjustments EHR necessary
REFERRAL	
30) Percentage of patients < 50 years with a fragility fracture* who are referred to a specialist	Adjustments EHR necessary
31) Percentage of osteoporosis patients with ≥ 2 new fractures despite > 1 year of treatment with bisphosphonates and good compliance who are referred to a specialist	Adjustments EHR necessary
32) Percentage of osteoporosis patients with GFR < 15 ml/min/1.73 m2 who are referred to a specialist	EHR-extractable at present
33) Percentage of pre-menopausal women and men < 50 years with a T score -2,5 who are referred to a specialist	Adjustments EHR necessary
34) Percentage of osteoporosis patients with: - a fragility fracture* in the last 2 years or/and - multiple (≥ 2) fragility fractures* or/and - a T-score < -3.5 or/and - FRAX risk of major osteoporotic fracture$ > 30%, hip fracture > 4.5% who are referred to a specialist	Adjustments EHR necessary

Legend: *Fragility fracture, Fracture sustained by a force similar to a fall from a standing position or less (most common is vertebral, pelvic, hip, femoral, humeral or forearm fracture). **Early menopause, < 45 years

$ Major osteoporotic fracture, Presence of a vertebral, pelvic, hip, femoral or humeral fracture or forearm fracture in patients ≥ 75 years old

¥ Clinical risk factors, Body mass index < 20 kg/m2, History of fragility fracture, History of hip fracture in either parent, 5 mg of prednisolone per day or equivalent for longer than 3 months, Alcohol intake > 3units/day, Frequent falls (≥ 1/year), Early non-substituted menopause

§ Contraindications bisphosphonates, Barrett esophagus, Esophageal abnormalities, Gastric ulcers, Gastric bypass,Severe GERD,Malabsorption, Chronic renal insufficiency eGFR, < 35 ml/min

Figure as presented in previously performed study by Heymans E. and Segaert E. et al.[13]

Appendix 3: Queries

Indicator ID	Indicatoren	Type	Query ID	Description	Conditions
All indicators	All indicators	Denominator	OST1	Patients in the clinical practice	- AND GMD belonging to one of the active users in the practice in the last 2y (verify that the most recent GMD is belonging to the practice); - AND patient status active; - AND age > 18y;
1a	Diagnosis, Screening	Denominator	OST2	Patients in the practice that are diagnosed with osteoporosis in their EMR	- AND All patients with whom the care element Osteoporosis (code: L95, M81.9) (active/passive relevant) is registered.
1a	Diagnosis	Numerator	OST3a	Number of patients in the practice that are diagnosed with osteoporosis in their EMR	**- AND OST1** - AND OST2
			OST3b	Patients who are receiving pharmacological osteoporosis treatment	- AND OST1 - AND Registered medication: Drugs affecting bone structure and mineralization (M05B) in the last 2 years
			OST4	Patients in the clinical practice who are diagnosed with osteoporosis in their EMR and/or are receiving pharmacological osteoporosis treatment	*OR OST3a *OR OST3b
1b	Screening	Numerator	OST5	Number of patients who are receiving pharmacological osteoporosis treatment that are diagnosed with osteoporosis	**- AND OST3b** - AND OST3a
2a	Technical Investigations	Numerator	OST6	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: White blood cell count	**- AND OST3a** - AND A record of lab result: White blood cell count (6690-2) after date of diagnosis of osteoporosis
2b	Technical Investigations	Numerator	OST7	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Red blood cell count	**- AND OST3a** - AND A record of lab result: Red blood cell count (789-8) after date of diagnosis of osteoporosis
2c	Technical Investigations	Numerator	OST8	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Platelet count	**- AND OST3a** - AND A record of lab result: Platelet count (777-3) after date of diagnosis of osteoporosis
2d	Technical Investigations	Numerator	OST9	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Hemoglobin	**- AND OST3a** - AND A record of lab result: Hemoglobin (718-7) after date of diagnosis of osteoporosis
2e	Technical Investigations	Numerator	OST10	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Hematocrit	**- AND OST3a** - AND A record of lab result: Hematocrit (4544-3) after date of diagnosis of osteoporosis
2f	Technical Investigations	Numerator	OST11	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: MCV	**- AND OST3a** - AND A record of lab result: MCV (787-2) after date of diagnosis of osteoporosis
2g	Technical Investigations	Numerator	OST12	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: MCH	**- AND OST3a** - AND A record of lab result: MCH (785-6) after date of diagnosis of osteoporosis

2h	Technical Investigations	Numerator	OST13	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: MCHC	**- AND OST3a** - AND A record of lab result: MCHC (786-4) after date of diagnosis of osteoporosis
2i	Technical Investigations	Numerator	OST14	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Neutrophiles	**- AND OST3a** - AND A record of lab result: Neutrophiles (751-8) after date of diagnosis of osteoporosis
2j	Technical Investigations	Numerator	OST15	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Neutrophiles absolute	**- AND OST3a** - AND A record of lab result: Neutrophiles absolute (704-7) after date of diagnosis of osteoporosis
2k	Technical Investigations	Numerator	OST16	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Lymphocytes	**- AND OST3a** - AND A record of lab result: Lymphocytes (736-9) after date of diagnosis of osteoporosis
2l	Technical Investigations	Numerator	OST17	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Lymphocytes absolute	**- AND OST3a** - AND A record of lab result: Lymphocytes absolute (731-0) after date of diagnosis of osteoporosis
2m	Technical Investigations	Numerator	OST18	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Creatinine	**- AND OST3a** - AND A record of lab result: Creatinine (2160-0) after date of diagnosis of osteoporosis
2n	Technical Investigations	Numerator	OST19	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Serum calcium	**- AND OST3a** - AND A record of lab result: Serum calcium (17861-6) after date of diagnosis of osteoporosis
2o	Technical Investigations	Numerator	OST20	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Phosphate	**- AND OST3a** - AND A record of lab result: Phosphate (2777-1) after date of diagnosis of osteoporosis
2p	Technical Investigations	Numerator	OST21	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: 25-OH vitamin D	**- AND OST3a** - AND A record of lab result: 25-OH-vitamin D (49589-3) after date of diagnosis of osteoporosis
2q	Technical Investigations	Numerator	OST22	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Total protein	**- AND OST3a** - AND A record of lab result: Total protein (2885-2) after date of diagnosis of osteoporosis
2r	Technical Investigations	Numerator	OST23	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Albumin	**- AND OST3a** - AND A record of lab result: Albumin (1751-7) after date of diagnosis of osteoporosis
2s	Technical Investigations	Numerator	OST24	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Alkaline	**- AND OST3a** - AND A record of lab result: Alkaline phosphatase (6768-6) after date of diagnosis of osteoporosis
2t	Technical Investigations	Numerator	OST25	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Ferritin	**- AND OST3a** - AND A record of lab result: Ferritin (2276-4) after date of diagnosis of osteoporosis
2u	Technical Investigations	Numerator	OST26	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Fe	**- AND OST3a** - AND A record of lab result: Fe (2498-4) after date of diagnosis of osteoporosis
2v	Technical Investigations	Numerator	OST27	Number of patients with osteoporosis in whom subsequent blood tests were investigated once after the diagnosis: Transferrin	**- AND OST3a** - AND A record of lab result: Transferrin (3041-2) after date of diagnosis of osteoporosis

			OST28	Patients with a history of a fragility fracture	- AND OST1 - AND all patients with registered care element: Unspecified osteoporosis with pathological fracture (Code: L95, M80.9)
			OST29	Patients with age>65 years	- AND OST1 - AND age>65y
			OST30	Patients with active smoking	- AND OST1 - AND Registered parameter: Smoking status = active (72166-2)
			OST31	Patients with BMI<20 kg/m²	- AND OST1 - AND Registered parameter: BMI <20 kg/m² - AND Date of registration of BMI <5 years ago
			OST32	Patients with a mother or father with a history of pathological fracture	- AND OST1 - AND Registered point of interest: Hip fracture (L75, S72.0) - AND relation status of person = “Father” and/or “Mother” and/or "Parent"
			OST33	Patients that used methylprednisolon for a period > 3 months	- AND OST1 - AND Registered medication: Methylpredniso(lo)nacetaat (H02AB04) - AND duration of intake > 3 months
			OST34	Patients with high alcohol consumption	- AND OST1 - AND Registered parameter: How often do you drink alcohol = 4 or more times/ week
			OST35	Patients who had a fall ≥1/ year ≤ 1 year before index date	- AND OST1 - AND Registered care element: Fall (A29, R26.8) - AND date of fall ≤ 1 year before index date
			OST36	Patients with premature menopause	- AND OST1 - AND Registered care element: Premature menopause (T99, E28.3)
			OST37	Patients with one or more clinical risk factors	-AND OST1 -AND * OR OST31 * OR OST32 * OR OST33 * OR OST34 * OR OST35 * OR OST36
			OST38	Patients with two or more risk factors	-AND OST1 -AND * OR OST29 AND OST30 * OR OST30 AND OST37 * OR OST29 AND OST37
			OST39	Patients with treatment of arotamase inhibitors, antiandrogens for 3 months or longer.	-AND OST1 - AND *OR - AND Registered medication: Aromatase inhibitors (L02BG) - AND Duration of intake > 3 months *OR -AND Registered medication: Antiandrogens (G03H) -AND Duration of intake > 3 months

4		Denominator	OST43	Patients with osteoporoses that have a history of smoking	- AND OST4 - AND registered parameter: Smoking status = active (72166-2) - AND registered parameter: Smoking status = <6 months stopped - AND registered parameter: Smoking status = quit
4		Numerator	OST44	Number of smoking patients with osteoporosis with a registration of smoking status during the past 2 years	**- AND OST43** - AND the patients with whom parameter: smoking status was registered <2 years
5		Numerator	OST45	The Number of patients with osteoporosis who were asked how often they drink alcohol in the last 2 years	**- AND OST4** - AND *OR Registered parameter: How often do you drink alcohol (<2 years)
6		Denominator	OST46	patients who either had a fracture or fall ≥1/ year	*OR OST28 *OR OST35
6		Numerator	OST47	The Number of patients who either had a fracture or fall ≥1/ year who were referred for physiotherapy (fall prevention and rehabilitation) less than 3 months after the fracture or fall.	**- AND OST46** - AND Registered prescription: physiotherapy - AND *OR Time between diagnosis of fall and Registered prescription <3 months *OR Time between diagnosis of fragility fracture and Registered prescription <3 months
8a		Numerator	OST49	Patients with osteoporosis who take Vitamin D Supplementation	**- AND OST4** - AND registered medication: Vitamin D and analogues (A11CC, A12AX, M05BB03, M05BB04, M05BB05, M05BB07, M05BB08, M05BB09) in the last 2 years
			OST 50	Patients with age >50y	- AND OST1 - AND age>50y
			OST 51a	patients with registered lab parameter: 25-OH vitamin D	- AND OST1 - AND A record of lab result: 25-OH-vitamin D (49589-3) in the last 2 years
8b		Numerator	OST51b	patients with whom registered lab parameter: Vitamin D <30ng (most recent result)	- AND OST1 - AND registered lab parameter: Vitamin D <30ng (most recent result) (49589-3)
			OST52	Patients over the of 50 years with a registered lab parameter Vitamin D <30ng (most recent result), with a clinical risk factor for osteoporosis	-AND OST50 -AND OST51b -AND OST37
			OST53	Patients over the of 50 years with a registered lab parameter Vitamin D <30ng (most recent result), with smoking status = active	-AND OST50 -AND OST51b -AND OST30
			OST54	Patients who take vitamin D supplementation	- AND OST1 - AND registered medication: Vitamin D and analogues (A11CC, A12AX, M05BB03, M05BB04, M05BB05, M05BB07, M05BB08, M05BB09)
9a		Numerator	OST55	Patients over the age of 50 years with a registered lab parameter Vitamin D <30ng (most recent result),	**-AND OST52** -AND OST54

				with a clinical risk factor for osteoporosis, who take vitamin D supplementaion	
9b		Numerator	OST56	Patients over the of 50 years with a registered lab parameter Vitamin D <30ng (most recent result), with smoking status = active, who take vitamin D supplementation	**-AND OST53** -AND OST54
10a		Denominator	OST57	Patients over the age of 65 years with one or more clinical risk factor	-AND OST29 -AND OST37
10a		Numerator	OST58	Patients over the age of 65 years with one or more clinical risk factor, who take vitamine D supplementation	**-AND OST57** -AND OST54
10b		Denominator	OST59	Patients over the age of 65 years with smoking status = active	-AND OST29 -AND OST30
10b		Numerator	OST60	Patients over the age of 65 years with smoking status = active, who take vitamine D supplementation	**-AND OST59** -AND OST54
11		Numerator	OST61	Number of patients with osteoporosis who have calcium intake in the form of medication	**- AND OST4** - AND Registered medication: Calcium (A12A) in the last 2 years
			OST62	Patients who have had a major osteoporotic fracture in the past 2 years	- AND OST1 - AND *OR - AND Registered Care element: Hip Fracture (L75, S72) - AND Date ≤ 2 year before index date *OR - AND Registered Care element: Pelvic Fracture (L76, S32.8) - AND Date ≤ 2 year before index date *OR - AND Registered Care element: Vertebral Fracture (L95, M80.9) - AND Date ≤ 2 year before index date *OR - AND Registered Care element: Femoral Fracture (L75, S72.9) - AND Date ≤ 2 year before index date *OR - AND Registered Care element: Humeral fracture (L76, S42.2) - AND Date ≤ 2 year before index date *OR - AND age >75 y - AND Registered Care element: Forearm fracture (L72, S52.0) - AND Date ≤ 2 year before index date
12a		Denominator	OST63	Patients with premature menopause, who have had a major osteoporotic fracture in the past 2 years	-AND OST36 -AND OST62
12a		Numerator	OST64	Patients with premature menopause, who have had a major osteoporotic fracture in the past 2 years, who have been treated with arotamase inhibitors, antiandrogens	**-AND OST63** -AND OST39

12b		Denominator	0ST65	Patients over the age of 50, who have had a major osteoporotic fracture in the past 2 years	-AND OST50 -AND OST62
12b		Numerator	OST66	Patients over the age of 50, who have had a major osteoporotic fracture in the past 2 years, who have been treated with pharmacological treatment	**-AND OST65** -AND OST39
			OST67	Patients with gastrointestinal or renal contra-indications for oral bisphosphonates	*OR Registered Care element: Barrett esophagus (D84, K22.1) *OR Registered Care element: Esophageal abnormalities (K22, K23, Q39) *OR Registered Care element: Gastric ulcers (D86, K25.9) *OR Registered Care element: Gastric bypass (A89, Z95.1) *OR Registered Care element: Severe GERD (D84, K21.9) *OR Registered Care element: Malabsorption (D99, K90.9) *OR 2 registered lab parameters: eGFR < 35 ml/min (48642-3) in measurements in the last 2 years, with time between measurements >3 months
			OST68	Patients with osteoporosis with gastrointestinal or renal contra-indications for oral bisphosphonates	-AND OST4 -AND OST67
13		Numerator	OST69	Patients with osteoporosis with gastrointestinal or renal contra-indications for oral bisphosphonates, who do not take oral bisphosphonates	**-AND OST68** -NOT Oral bisphosphonates (M05BA-M05BB) in the last 2 years
			OST70	Patients with gastrointestinal contra-indications for oral bisphosphonates	*OR Registered Care element: Barrett esophagus (D84, K22.1) *OR Registered Care element: Esophageal abnormalities (K22, K23, Q39) *OR Registered Care element: Gastric ulcers (D86, K25.9) *OR Registered Care element: Gastric bypass (A89, Z95.1) *OR Registered Care element: Severe GERD (D84, K21.9) *OR Registered Care element: Malabsorption (D99, K90.9)
			OST71	Patients with eGFR >35 ml/min	- AND Registered lab parameter: eGFR > 35ml/min (48642-3) as last result
14		Denominator	OST72	Number of osteoporosis patients with gastrointestinal contra-indications and eGFR ≥ 35 ml/min	-AND OST4 -AND OST70 -AND OST71
14		Numerator	OST73	Number of osteoporosis patients with gastrointestinal contra-indications and eGFR ≥ 35 ml/min, receiving intravenous bisphosphonates	**-AND OST72** - AND Registered Active medication: IV Bisphosphonates (M05BA03, M05BA08)
15		Denominator	OST74	Patients with osteoporosis with a eGFR <35ml/min	-AND OST4 -AND Registered lab parameter: eGFR < 35ml/min (48642-3)
15		Numerator	OST75	Patients with osteoporosis with a eGFR <35ml/min, who receive subcutaneous Denosumab	**- AND OST74** - AND Registered Active medication Denosumab (M05BX04)
16		Denominator	OST76	Patients with osteoporosis who had a hip fracture	- AND OST4 - AND Registered Care element: Hip Fracture (L75, S72) all-time

16		Numerator	OST77	Osteoporosis patients treated with Zoledronate after a hip fracture.	**- AND OST76** - AND Registered Active medication: Zoledronate (M05BA08) in the 2 years after registered care element: Hip Fracture (L75, S72)
17		Denominator	OST78	Osteoporosis patients receiving subcutaneous denosumab	- AND OST3a - AND Registered Active medication Denosumab (M05BX04)
17		Numerator	OST79	Osteoporosis patients receiving subcutaneous denosumab in whom their serum calcium levels were checked	**- AND OST78** - AND Registered lab parameter: Serum calcium (17861-6)
18		Numerator	OST80	Number of osteoporosis patients who had check-ups with measurements of height (ever) and weight (in the last year)	**- AND OST4** - AND Registered parameter: Height (8302-2) - AND *AND Registered parameter: Weight (29463-7) *AND Date of registration ≤ 1 year before index date
19		Denominator	OST81	Patients with osteoporosis who take bisphosphonates	- AND OST4 - AND Registered medication: Bisphosphonates (M05BA, M05BB) in the last 2 years
19		Numerator	OST82	Osteoporosis patients taking bisphosphonates who had annual check of creatinine, calcium and vitamin D.	**- AND OST81** - AND Lab parameter Creatinine (2160-0) - AND Lab parameter Calcium (17861-6) - AND Lab parameter Vitamine D (49589-3) - AND Time of registration ≤ 1 year before index date

Appendix 4: Heatmap

practice_id	1a	1b	2a	2b	2c	2d	2e	2f	2g	2h	2i	2j	2k	2l	2m	2n	2o	2p	2q	2r	2s	2t	2u	2v	5,00	8,00	9a	9b	10a	10b	11,00	13,00	14,00	15,00	16,00	17,00	18,00	19,00
0000-0012	0,01	0,30	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,38	0,00	1,00	0,88	1,00	0,63	0,25	0,88	0,88	0,38	1,00	0,88	0,88	0,88	0,00	0,67	0,69	0,71	0,59	0,60	0,40	1,00	0,00		0,00	0,50	0,00	0,40
0000-0020	0,02	0,58	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,86	0,43	0,93	0,93	0,93	0,64	0,57	0,71	0,50	0,57	0,79	0,79	0,71	0,43	0,00	0,59	0,38	0,43	0,44	0,50	0,23	0,00		0,50	0,00	0,60	0,00	0,13
0000-0039	0,01	0,33	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,00	0,75	0,83	0,75	0,92	0,83	0,75	0,75	0,17	0,25	0,83	0,50	0,83	0,83	0,00	0,79	0,54	0,45	0,67	0,52	0,63	0,67	1,00	0,75	0,50	1,00	0,08	0,43
0000-0054	0,02	0,60	0,88	0,88	0,88	0,86	0,88	0,88	0,86	0,86	0,14	0,84	0,50	0,84	0,88	0,76	0,60	0,80	0,68	0,36	0,82	0,82	0,80	0,32	0,00	0,59	0,39	0,27	0,50	0,25	0,51	0,63	0,35	0,42	0,67	0,94	0,01	0,43
0000-0057	0,03	0,66	0,94	0,93	0,94	0,94	0,94	0,93	0,93	0,94	0,06	0,39	0,92	0,91	0,94	0,84	0,71	0,79	0,74	0,55	0,82	0,79	0,57	0,36	0,00	0,57	0,41	0,38	0,51	0,42	0,31	0,50	0,00	0,23	0,00	0,96	0,04	0,45
0000-0071	0,02	0,65	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,82	0,00	0,91	0,91	0,91	0,65	0,56	0,82	0,62	0,21	0,59	0,85	0,85	0,85	0,00	0,78	0,44	0,25	0,55	0,00	0,57	0,57	0,00	0,25	0,33	0,91	0,04	0,25
0000-0107	0,02	0,54	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,18	0,08	0,97	0,65	0,97	0,81	0,75	0,63	0,76	0,37	0,94	0,86	0,84	0,68	0,01	0,59	0,46	0,39	0,41	0,35	0,17	0,65	0,00	0,10	0,05	0,90	0,02	0,21
0000-0128	0,03	0,56	0,86	0,86	0,85	0,87	0,87	0,87	0,87	0,86	0,42	0,83	0,68	0,83	0,87	0,64	0,23	0,72	0,51	0,20	0,50	0,80	0,68	0,67	0,01	0,74	0,51	0,52	0,57	0,52	0,46	0,53	0,20	0,62	0,12	0,96	0,08	0,29
0000-0133	0,04	0,61	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,93	0,04	0,96	0,93	0,98	0,90	0,69	0,89	0,71	0,62	0,85	0,90	0,88	0,72	0,01	0,68	0,59	0,56	0,65	0,57	0,42	0,47	0,06	0,52	0,24	0,99	0,06	0,43
0000-0147	0,03	0,74	0,95	0,95	0,91	0,95	0,93	0,95	0,95	0,95	0,02	0,42	0,93	0,46	0,95	0,84	0,74	0,44	0,49	0,47	0,91	0,61	0,47	0,44	0,00	0,77	0,57	0,36	0,48	0,31	0,68	0,77	0,11	0,36	0,17	1,00	0,01	0,28
0000-0151	0,04	0,64	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,01	0,89	0,49	0,89	0,90	0,63	0,30	0,76	0,55	0,35	0,83	0,89	0,38	0,32	0,13	0,64	0,41	0,37	0,48	0,37	0,49	0,65	0,00	0,74	0,00	0,83	0,11	0,27
0000-0158	0,01	0,44	0,80	0,82	0,75	0,86	0,82	0,82	0,82	0,82	0,05	0,00	0,48	0,80	0,86	0,50	0,18	0,66	0,48	0,18	0,32	0,80	0,52	0,18	0,13	0,72	0,46	0,44	0,45	0,44	0,61	0,50	0,00	0,38		0,78	0,04	0,26
0000-0162	0,02	0,63	0,93	0,94	0,90	0,94	0,94	0,94	0,94	0,94	0,05	0,03	0,93	0,23	0,95	0,60	0,26	0,46	0,35	0,24	0,74	0,91	0,85	0,41	0,52	0,52	0,38	0,42	0,28	0,27	0,35	0,43	0,33	0,42	0,07	0,73	0,05	0,16
0000-0168	0,00	0,32	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,75	0,00	0,92	0,75	0,92	0,33	0,25	0,75	0,25	0,08	0,75	0,83	0,75	0,67	0,00	0,52	0,20	0,30	0,16	0,32	0,38					0,40	0,00	0,09
0000-0171	0,03	0,66	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,14	0,92	0,92	0,92	0,81	0,78	0,86	0,76	0,78	0,89	0,86	0,86	0,78	0,00	0,69	0,48	0,33	0,41	0,36	0,38	0,50	0,00	0,00	0,00	1,00	0,02	0,15
0000-0181	0,03	0,82	0,95	0,94	0,94	0,95	0,94	0,94	0,94	0,94	0,06	0,03	0,70	0,36	0,97	0,68	0,49	0,77	0,55	0,33	0,69	0,91	0,77	0,49	0,21	0,76	0,47	0,48	0,55	0,55	0,15	0,33	0,16	0,40	0,20	0,75	0,07	0,15
0000-0182	0,02	0,84	0,80	0,80	0,78	0,80	0,80	0,80	0,80	0,80	0,73	0,04	0,76	0,75	0,82	0,65	0,37	0,67	0,27	0,27	0,76	0,75	0,75	0,75	0,00	0,55	0,51	0,57	0,44	0,60	0,45	0,40	0,00	1,00	1,00	0,67	0,05	0,50
0000-0231	0,02	0,68	0,78	0,76	0,37	0,79	0,76	0,76	0,76	0,76	0,71	0,01	0,75	0,74	0,80	0,35	0,18	0,68	0,21	0,12	0,63	0,73	0,24	0,13	0,46	0,52	0,46	0,51	0,42	0,48	0,37	0,70	0,12	0,50	0,00	0,62	0,28	0,11
0000-0249	0,02	0,63	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,90	0,06	0,92	0,92	0,94	0,71	0,63	0,85	0,45	0,40	0,76	0,90	0,90	0,60	0,04	0,48	0,39	0,58	0,43	0,51	0,40	0,50	0,00	0,25	0,09	0,93	0,05	0,23
0000-0252	0,02	0,56	0,82	0,82	0,82	0,82	0,82	0,82	0,82	0,82	0,12	0,00	0,65	0,82	0,82	0,88	0,71	0,88	0,82	0,47	0,82	0,82	0,82	0,82	0,00	0,29	0,40		0,36		0,19	0,00	0,00			1,00	0,00	0,29
0000-0259	0,01	0,57	0,92	0,92	0,86	0,92	0,92	0,92	0,92	0,92	0,10	0,00	0,84	0,86	0,92	0,48	0,30	0,82	0,30	0,14	0,64	0,92	0,88	0,80	0,03	0,70	0,47	0,45	0,49	0,48	0,44	0,00	0,25	0,75	0,00	0,71	0,00	0,09
0000-0264	0,03	0,52	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,01	0,09	0,90	0,37	0,90	0,75	0,69	0,54	0,48	0,21	0,79	0,73	0,69	0,46	0,02	0,53	0,36	0,33	0,33	0,25	0,44	0,50	0,08	0,67	0,07	0,90	0,06	0,07
0000-0266	0,02	0,56	0,91	0,89	0,90	0,91	0,89	0,89	0,89	0,89	0,18	0,79	0,91	0,90	0,91	0,76	0,64	0,82	0,49	0,36	0,80	0,86	0,78	0,82	0,06	0,67	0,39	0,37	0,53	0,49	0,55	0,50	0,25	0,33	0,13	0,83	0,05	0,47
0000-0278	0,02	0,84	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,02	0,87	0,37	0,87	0,91	0,47	0,07	0,87	0,89	0,16	0,91	0,89	0,90	0,61	0,07	0,65	0,37	0,32	0,45	0,40	0,51	0,50			0,20	0,80	0,07	0,11
0000-0285	0,03	0,70	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,07	0,00	0,93	0,86	0,93	0,43	0,29	0,64	0,43	0,21	0,86	0,79	0,79	0,50	0,00	0,59	0,44	0,40	0,40	0,30	0,29	0,00	0,00	0,00		0,33	0,06	0,14
0000-0307	0,04	0,63	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,89	0,13	0,91	0,89	0,96	0,42	0,38	0,82	0,18	0,24	0,56	0,44	0,89	0,24	0,00	0,65	0,29	0,38	0,38	0,36	0,33	0,45	0,00	0,75	0,13	0,83	0,03	0,11
0000-0322	0,02	0,51	0,88	0,86	0,88	0,88	0,86	0,86	0,86	0,86	0,72	0,00	0,86	0,81	0,86	0,60	0,37	0,72	0,37	0,33	0,67	0,81	0,81	0,49	0,00	0,60	0,39	0,20	0,44	0,67	0,39	0,33	0,50	0,29	0,00	0,80	0,03	0,21
0000-0324	0,02	0,58	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,63	0,00	0,72	0,75	0,81	0,75	0,13	0,78	0,22	0,16	0,31	0,78	0,78	0,28	0,04	0,62	0,35	0,48	0,47	0,67	0,44	0,71	0,17	0,67	0,00	0,95	0,02	0,45
0000-0328	0,02	0,52	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,96	0,03	0,96	0,97	0,97	0,79	0,75	0,91	0,52	0,40	0,97	0,97	0,97	0,40	0,00	0,51	0,38	0,36	0,44	0,40	0,31	0,64	0,00	0,60	0,00	0,96	0,02	0,27
0000-0330	0,02	0,60	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,31	0,02	0,84	0,31	0,82	0,73	0,49	0,73	0,78	0,49	0,57	0,80	0,78	0,53	0,03	0,80	0,57	0,49	0,64	0,58	0,63	0,70	0,14	0,43	0,17	0,91	0,01	0,47
0000-0331	0,02	0,40	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,10	0,81	0,81	0,81	0,77	0,42	0,77	0,55	0,35	0,74	0,68	0,71	0,61	0,10	0,49	0,56	0,64	0,52	0,57	0,22	1,00	0,00	0,75	0,00	0,93	0,00	0,32
0000-0355	0,04	0,72	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,70	0,03	0,93	0,68	0,93	0,65	0,65	0,70	0,20	0,08	0,90	0,85	0,78	0,18	0,08	0,71	0,63	1,00	0,69	0,80	0,49			0,00		1,00	0,39	0,29
0000-0362	0,02	0,63	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,00	0,91	0,93	0,91	0,98	0,93	0,91	0,89	0,47	0,33	0,89	0,91	0,60	0,58	0,10	0,70	0,53	0,61	0,55	0,58	0,49	0,38	0,29	0,40	0,50	1,00	0,06	0,63
0000-0396	0,03	0,59	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,44	0,46	0,88	0,46	0,90	0,84	0,65	0,87	0,49	0,38	0,76	0,87	0,87	0,50	0,04	0,81	0,49	0,52	0,59	0,64	0,70	0,71	0,00	0,57	0,00	0,91	0,13	0,35
0000-0420	0,02	0,66	0,95	0,96	0,95	0,96	0,96	0,96	0,96	0,96	0,76	0,02	0,92	0,92	0,95	0,70	0,47	0,82	0,46	0,42	0,87	0,86	0,84	0,70	0,01	0,50	0,35	0,24	0,40	0,24	0,33	0,79	0,00	0,38	0,00	0,93	0,09	0,22
0000-0426	0,03	0,74	0,89	0,86	0,87	0,89	0,86	0,85	0,85	0,85	0,38	0,05	0,72	0,85	0,90	0,45	0,27	0,86	0,53	0,29	0,50	0,82	0,57	0,52	0,04	0,68	0,65	0,55	0,64	0,51	0,48	0,52	0,00	0,50	0,00	0,69	0,06	0,11
0000-0427	0,02	0,48	0,83	0,83	0,83	0,83	0,83	0,83	0,83	0,83	0,78	0,61	0,83	0,78	0,89	0,89	0,83	0,33	0,56	0,22	0,83	0,78	0,78	0,78	0,00	0,53	0,00	0,40	0,50	0,45	0,30	0,00	0,00	0,75	0,00	1,00	0,07	0,00
0000-0450	0,01	0,60	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,89	0,11	0,05	0,61	0,61	0,89	0,59	0,30	0,73	0,36	0,36	0,70	0,80	0,70	0,68	0,02	0,64	0,38	0,32	0,51	0,44	0,57	0,83	0,00	0,33	0,00	0,88	0,03	0,22
0000-0495	0,03	0,78	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,94	0,31	0,95	0,95	0,95	0,58	0,44	0,92	0,47	0,37	0,95	0,90	0,47	0,44	0,15	0,52	0,28	0,33	0,29	0,25	0,28	0,33	0,33	0,67	0,00	0,76	0,06	0,35
0000-0496	0,01	0,07	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,00	1,00	1,00	1,00	1,00	0,93	1,00	1,00	0,60	1,00	0,93	1,00	0,53	0,00	0,55	0,52	0,50	0,59	0,41	0,35	0,33	0,50	0,50	1,00		0,00	0,60
0000-0497	0,01	0,62	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,77	0,12	0,81	0,08	0,81	0,62	0,62	0,81	0,77	0,77	0,77	0,81	0,77	0,77	0,00	0,62	0,21	1,00	0,39		0,38			1,00		1,00	0,00	0,24
0000-0502	0,02	0,68	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,78	0,10	0,90	0,88	0,90	0,57	0,47	0,86	0,28	0,21	0,72	0,90	0,90	0,90	0,00	0,61	0,49	0,36	0,54	0,38	0,46	0,25	0,00	0,20	0,20	0,84	0,06	0,20
0000-0513	0,03	0,93	1,00	0,98	1,00	1,00	0,98	0,98	0,96	0,96	0,15	0,12	1,00	0,40	1,00	0,88	0,63	0,60	0,63	0,56	0,96	0,94	0,73	0,60	0,04	0,63	0,48	0,38	0,37	0,31	0,28	0,46	0,00	0,17	0,25	1,00	0,41	0,20
0000-0517	0,03	0,80	0,83	0,83	0,83	0,83	0,83	0,83	0,83	0,83	0,18	0,02	0,71	0,83	0,83	0,60	0,38	0,76	0,41	0,28	0,51	0,80	0,45	0,28	0,54	0,30	0,39	0,54	0,24	0,30	0,12	0,58	0,00	1,00	0,00	1,00	0,03	0,17
0000-0519	0,02	0,73	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,73	0,62	0,85	0,92	0,92	0,47	0,40	0,67	0,27	0,27	0,48	0,75	0,82	0,53	0,03	0,57	0,59	0,62	0,54	0,37	0,43	0,44	0,00	0,33	0,00	0,53	0,06	0,33
0000-0525	0,03	0,62	0,84	0,83	0,82	0,88	0,83	0,88	0,88	0,87	0,01	0,22	0,84	0,23	0,88	0,65	0,47	0,74	0,36	0,34	0,68	0,73	0,45	0,32	0,12	0,61	0,34	0,38	0,35	0,37	0,39	0,59	0,07	0,45	0,16	0,88	0,06	0,29
0000-0535	0,02	0,50	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,17	0,00	0,67	0,92	0,92	0,33	0,33	0,83	0,83	0,08	0,83	0,92	0,92	0,83	0,05	0,50	0,67	0,86	0,65	0,60	0,32	0,00	0,00	0,00		0,40	0,00	0,19
0000-0563	0,04	0,50	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,96	0,06	0,97	0,97	0,97	0,86	0,59	0,84	0,49	0,71	0,87	0,73	0,50	0,47	0,00	0,76	0,62	0,45	0,75	0,46	0,46	0,63	0,00	0,70	0,15	0,97	0,05	0,48
0000-0570	0,01	1,00	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,40	0,20	0,60	0,40	0,60	0,60	0,40	0,60	0,20	0,40	0,60	0,60	0,40	0,40	0,00	0,80	0,50	0,00	0,24	0,06	0,80	1,00		1,00		0,67	0,20	1,00
0000-0572	0,01	0,22	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,67	1,00	1,00	0,83	1,00	0,75	0,50	0,92	1,00	0,33	1,00	1,00	1,00	0,83	0,02	0,67	0,31	0,33	0,68	0,67	0,31	0,00	0,00	0,50	0,00	1,00	0,06	0,23
0000-0574	0,04	0,74	0,90	0,89	0,89	0,90	0,89	0,89	0,89	0,89	0,03	0,27	0,80	0,89	0,89	0,57	0,48	0,73	0,62	0,46	0,81	0,87	0,42	0,38	0,01	0,60	0,53	0,46	0,56	0,47	0,45	0,44	0,17	0,15	0,05	0,77	0,03	0,30
0000-0583	0,02	0,70	0,93	0,93	0,77	0,93	0,93	0,93	0,93	0,93	0,03	0,00	0,73	0,85	0,93	0,61	0,38	0,61	0,41	0,20	0,72	0,69	0,54	0,42	0,11	0,69	0,53	0,51	0,53	0,44	0,31	0,67	0,10	0,57	0,00	0,95	0,05	0,08

practice_id	1a	1b	2a	2b	2c	2d	2e	2f	2g	2h	2i	2j	2k	2l	2m	2n	2o	2p	2q	2r	2s	2t	2u	2v	5,00	8,00	9a	9b	10a	10b	11,00	13,00	14,00	15,00	16,00	17,00	18,00	19,00
0000-0603	0,01	0,68	0,96	0,93	0,93	0,96	0,93	0,93	0,93	0,93	0,02	0,00	0,67	0,87	0,96	0,74	0,54	0,78	0,33	0,11	0,63	0,74	0,46	0,35	0,09	0,64	0,52	0,49	0,40	0,32	0,45	0,56	0,08	0,00	0,13	0,88	0,05	0,27
0000-0643	0,02	0,50	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,00	0,00	0,64	0,76	0,84	0,80	0,80	0,60	0,44	0,20	0,72	0,68	0,44	0,36	0,00	0,73	0,48	0,42	0,55	0,38	0,53	0,40	0,67	0,25	0,40	1,00	0,15	0,24
0000-0645	0,01	0,41	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,13	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,00	0,46	0,56	0,43	0,61	0,41	0,14	0,67	0,00	0,00		1,00	0,00	0,47
0000-0663	0,03	0,65	0,79	0,79	0,77	0,80	0,79	0,79	0,79	0,79	0,13	0,77	0,31	0,77	0,81	0,40	0,21	0,31	0,16	0,08	0,21	0,31	0,19	0,17	0,00	0,73	0,75	0,58	0,56	0,50	0,64	0,33	0,31	0,40	0,50	0,86	0,05	0,11
0000-0680	0,03	0,66	0,95	0,95	0,94	0,95	0,95	0,95	0,95	0,95	0,78	0,33	0,84	0,25	0,95	0,71	0,57	0,77	0,41	0,31	0,77	0,76	0,70	0,54	0,02	0,75	0,49	0,59	0,60	0,46	0,53	0,44	0,50	0,25	1,00	0,92	0,03	0,30
0000-0711	0,02	0,69	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,37	0,03	0,95	0,95	0,95	0,80	0,61	0,69	0,41	0,47	0,76	0,68	0,60	0,60	0,81	0,58	0,23	0,18	0,21	0,21	0,47	0,42	0,30	0,25	0,24	0,88	0,31	0,23
0000-0735	0,02	0,59	0,90	0,90	0,89	0,90	0,90	0,90	0,90	0,90	0,80	0,00	0,86	0,81	0,89	0,46	0,19	0,68	0,40	0,39	0,51	0,76	0,57	0,46	0,08	0,55	0,61	0,53	0,54	0,43	0,36	0,82	0,00	0,56	0,00	0,84	0,08	0,11
0000-0739	0,04	0,70	0,95	0,95	0,88	0,95	0,95	0,95	0,95	0,95	0,88	0,00	0,90	0,95	0,93	0,68	0,59	0,41	0,39	0,51	0,63	0,76	0,73	0,46	0,19	0,77	0,47	0,45	0,42	0,30	0,21	0,47	0,17	0,25	0,25	0,89	0,03	0,31
0000-0745	0,01	0,47	0,88	0,88	0,85	0,88	0,88	0,88	0,88	0,88	0,88	0,00	0,88	0,88	0,88	0,58	0,42	0,79	0,42	0,30	0,79	0,88	0,88	0,88	0,11	0,52	0,44	0,49	0,52	0,45	0,20	0,33	0,00	0,50	0,67	0,78	0,06	0,25
0000-0746	0,01	0,17	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,00	0,00	0,75	1,00	1,00	0,38	0,13	0,63	1,00	0,25	1,00	1,00	0,38	0,13	0,00	0,52	0,50	0,00	0,36	0,67	0,48	0,00		1,00		0,67	0,00	0,10
0000-0749	0,04	0,73	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,17	0,23	0,93	0,59	0,93	0,82	0,52	0,73	0,65	0,58	0,90	0,81	0,55	0,38	0,02	0,78	0,45	0,43	0,55	0,58	0,58	0,70	0,28	0,60	0,12	0,90	0,04	0,30
0000-0754	0,05	0,93	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,95	0,02	0,95	0,96	0,96	0,81	0,70	0,93	0,52	0,54	0,73	0,95	0,44	0,37	0,13	0,53	0,57	0,59	0,60	0,65	0,28	0,50	0,06	0,50	0,00	0,95	0,02	0,40
0000-0758	0,03	0,62	0,96	0,84	0,91	0,95	0,84	0,84	0,82	0,82	0,68	0,02	0,80	0,71	0,98	0,73	0,32	0,70	0,39	0,45	0,61	0,45	0,27	0,21	0,30	0,77	0,63	0,66	0,40	0,38	0,39	0,42	0,00	0,50	0,17	0,86	0,11	0,26
0000-0779	0,02	0,60	0,80	0,80	0,68	0,80	0,80	0,80	0,80	0,78	0,00	0,38	0,70	0,40	0,80	0,58	0,53	0,28	0,35	0,40	0,55	0,50	0,38	0,30	0,24	0,63	0,39	0,52	0,41	0,32	0,35	0,63	0,00	0,00	0,00	1,00	0,09	0,11
0000-0782	0,01	0,32	0,94	0,94	0,93	0,94	0,94	0,94	0,94	0,94	0,88	0,04	0,94	0,89	0,91	0,60	0,34	0,71	0,51	0,35	0,69	0,84	0,62	0,46	0,03	0,57	0,34	0,27	0,38	0,33	0,35	0,35	0,15	0,29	0,10	0,84	0,04	0,15
0000-0791	0,02	0,60	0,87	0,88	0,87	0,89	0,89	0,89	0,89	0,88	0,46	0,75	0,66	0,85	0,89	0,55	0,30	0,73	0,35	0,19	0,70	0,76	0,73	0,38	0,06	0,64	0,47	0,45	0,44	0,47	0,44	0,70	0,14	0,26	0,19	0,73	0,09	0,25
0000-0795	0,02	0,65	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,89	0,21	0,94	0,90	0,91	0,67	0,51	0,89	0,44	0,44	0,72	0,85	0,79	0,54	0,14	0,63	0,32	0,34	0,37	0,41	0,41	0,44	0,16	0,38		0,89	0,09	0,30
0000-0816	0,03	0,73	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,34	0,85	0,83	0,85	0,98	0,79	0,72	0,57	0,55	0,53	0,77	0,72	0,68	0,49	0,05	0,78	0,42	0,22	0,31	0,21	0,67	0,50	0,00	0,30	0,00	0,92	0,00	0,00
0000-0851	0,02	0,64	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,89	0,00	0,95	0,95	0,96	0,56	0,33	0,51	0,31	0,24	0,70	0,56	0,55	0,50	0,51	0,71	0,64	0,58	0,42	0,29	0,50	0,54	0,00	0,43	0,00	0,87	0,03	0,14
0000-0856	0,02	0,52	0,82	0,82	0,82	0,82	0,82	0,82	0,82	0,82	0,30	0,45	0,54	0,82	0,82	0,74	0,32	0,78	0,46	0,27	0,77	0,82	0,78	0,23	0,02	0,50	0,30	0,50	0,40	0,62	0,24	0,40	0,00	0,50	0,25	0,85	0,05	0,38
0000-0868	0,05	0,77	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,21	0,25	0,83	0,42	0,92	0,75	0,71	0,71	0,63	0,58	0,71	0,83	0,63	0,58	0,26	0,52	0,23	0,30	0,24	0,00	0,48	0,00	0,50		0,33		0,15	0,23
0000-0869	0,02	0,30	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,55	0,45	0,00	0,45	0,55	0,55	0,55	0,45	0,45	0,18	0,18	0,55	0,55	0,09	0,00	0,00	0,50	0,50	0,67	0,80	0,63	0,23	0,00	0,00	0,33		1,00	0,03	0,33
0000-0878	0,02	0,48	0,95	0,94	0,95	0,94	0,94	0,94	0,94	0,94	0,90	0,33	0,94	0,94	0,95	0,78	0,67	0,84	0,81	0,84	0,78	0,90	0,89	0,57	0,13	0,41	0,20	0,16	0,26	0,23	0,20	0,73	0,00	0,56	0,25	0,95	0,03	0,33
0000-0900	0,03	0,85	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,00	0,00	0,88	0,04	0,88	0,60	0,60	0,80	0,84	0,20	0,60	0,88	0,68	0,56	0,00	0,71	0,28	0,33	0,40	0,39	0,68	0,00	0,00		0,00	0,75	0,00	0,00
0000-0919	0,02	0,74	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,88	0,00	0,00	0,69	0,88	0,88	0,67	0,52	0,77	0,29	0,19	0,46	0,77	0,44	0,27	0,08	0,76	0,48	0,55	0,51	0,53	0,52	0,82	0,00	0,20	0,00	0,75	0,03	0,23
0000-0920	0,01	0,61	0,86	0,86	0,86	0,86	0,86	0,86	0,86	0,86	0,00	0,00	0,86	0,00	0,86	0,21	0,14	0,64	0,57	0,14	0,57	0,86	0,86	0,57	0,00	0,67	0,80	0,67	0,80	0,50	0,52	0,00	0,67	0,00	0,25	0,67	0,05	0,09
0000-0943-0000-1099	0,01	0,51	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,06	0,45	0,77	0,46	0,91	0,49	0,22	0,77	0,60	0,35	0,85	0,85	0,78	0,56	0,00	0,68	0,39	0,32	0,47	0,43	0,61	0,70	0,17	0,67	0,25	0,59	0,02	0,24
0000-0944	0,01	0,67	0,57	0,64	0,43	0,64	0,64	0,64	0,64	0,64	0,00	0,00	0,36	0,57	0,71	0,43	0,07	0,50	0,29	0,29	0,21	0,50	0,07	0,07	0,59	0,82	0,55	0,48	0,61	0,56	0,65	0,67	0,00		0,00	1,00	0,41	0,13
0000-0969	0,01	0,50	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,00	0,58	0,75	0,67	0,75	0,42	0,42	0,58	0,42	0,25	0,75	0,67	0,42	0,58	0,00	0,78	0,20	0,00	0,45	0,00	0,28	0,00	0,00		0,00	0,75	0,00	0,00
0000-0999	0,03	0,72	0,96	0,95	0,95	0,95	0,95	0,95	0,95	0,95	0,01	0,02	0,96	0,02	0,95	0,63	0,36	0,79	0,90	0,35	0,60	0,85	0,69	0,25	0,01	0,66	0,46	0,54	0,53	0,57	0,48	0,62	0,25	0,18	0,00	0,89	0,11	0,14
0000-1004	0,02	0,71	0,84	0,84	0,84	0,85	0,84	0,84	0,84	0,84	0,13	0,02	0,70	0,80	0,85	0,75	0,39	0,68	0,59	0,36	0,59	0,78	0,37	0,35	0,14	0,57	0,40	0,31	0,39	0,39	0,42	0,63	0,04	0,38	0,00	0,91	0,10	0,38
0000-1010	0,02	0,68	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,02	0,03	0,85	0,04	0,86	0,73	0,39	0,72	0,78	0,45	0,80	0,79	0,74	0,45	0,12	0,71	0,52	0,47	0,52	0,38	0,56	0,38	0,20	0,29	0,57	0,86	0,09	0,22
0000-1011	0,02	0,73	0,91	0,91	0,85	0,91	0,91	0,91	0,91	0,91	0,82	0,23	0,87	0,85	0,89	0,51	0,48	0,79	0,46	0,40	0,60	0,83	0,44	0,33	0,02	0,32	0,33	0,23	0,42	0,29	0,23	0,67	0,00	0,50	0,00	0,92	0,12	0,15
0000-1038	0,01	0,29	0,77	0,77	0,77	0,77	0,77	0,77	0,77	0,77	0,71	0,35	0,77	0,74	0,77	0,68	0,58	0,68	0,52	0,35	0,68	0,74	0,65	0,39	0,06	0,57	0,35	0,25	0,34	0,50	0,36	0,33	0,00	0,43	0,33	0,75	0,00	0,25
0000-1041	0,03	0,63	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,81	0,05	0,73	0,81	0,76	0,81	0,69	0,41	0,63	0,17	0,32	0,64	0,56	0,53	0,49	0,17	0,80	0,39	0,47	0,46	0,49	0,56	0,44	0,20	0,67	0,38	0,63	0,10	0,49
0000-1047	0,03	0,86	0,91	0,91	0,91	0,91	0,91	0,90	0,90	0,90	0,16	0,03	0,83	0,39	0,93	0,75	0,39	0,83	0,54	0,41	0,86	0,88	0,80	0,70	0,15	0,67	0,57	0,53	0,64	0,55	0,31	0,53	0,07	0,36	0,22	0,90	0,06	0,26
0000-1053	0,02	0,47	0,90	0,87	0,90	0,92	0,85	0,92	0,92	0,90	0,00	0,21	0,85	0,21	0,92	0,64	0,38	0,77	0,23	0,31	0,79	0,82	0,49	0,31	0,21	0,70	0,63	0,71	0,64	0,68	0,36	0,57	0,40	0,50	0,33	0,75	0,10	0,23
0000-1056	0,02	0,55	0,93	0,93	0,90	0,93	0,93	0,93	0,93	0,93	0,87	0,02	0,92	0,89	0,94	0,63	0,42	0,71	0,54	0,35	0,69	0,76	0,67	0,48	0,01	0,70	0,47	0,45	0,46	0,37	0,58	0,50	0,20	0,26	0,19	0,78	0,02	0,25
0000-1064	0,04	0,82	0,93	0,93	0,93	0,93	0,92	0,91	0,91	0,91	0,73	0,75	0,93	0,80	0,93	0,82	0,80	0,88	0,79	0,52	0,91	0,91	0,88	0,68	0,03	0,77	0,70	0,59	0,67	0,44	0,51	0,25	0,22	0,14	0,10	0,87	0,21	0,57
0000-1069	0,03	0,64	0,77	0,87	0,73	0,87	0,87	0,87	0,87	0,87	0,70	0,00	0,72	0,72	0,87	0,69	0,32	0,77	0,40	0,32	0,34	0,76	0,70	0,35	0,25	0,67	0,48	0,39	0,49	0,44	0,48	0,41	0,12	0,50	0,25	0,88	0,19	0,30
0000-1076	0,04	0,58	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,94	0,21	0,96	0,96	0,97	0,86	0,57	0,81	0,70	0,66	0,78	0,90	0,78	0,49	0,00	0,55	0,43	0,42	0,49	0,47	0,36	0,66	0,09	0,50	0,00	0,95	0,02	0,32
0000-1077	0,02	0,61	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,00	0,48	0,92	0,49	0,92	0,67	0,60	0,40	0,45	0,52	0,90	0,65	0,35	0,34	0,36	0,59	0,46	0,40	0,30	0,22	0,47	0,50	0,11	0,33	0,25	0,96	0,04	0,22
0000-1086	0,01	0,57	0,73	0,80	0,73	0,80	0,80	0,80	0,80	0,80	0,07	0,07	0,67	0,67	0,80	0,60	0,33	0,60	0,47	0,40	0,73	0,60	0,33	0,33	0,28	0,67	0,82	0,72	0,44	0,39	0,44	0,50	0,50	0,25	0,25	1,00	0,06	0,43
0000-1115-0000-0669	0,03	0,66	0,92	0,92	0,86	0,92	0,92	0,92	0,92	0,92	0,80	0,57	0,87	0,57	0,91	0,50	0,35	0,35	0,18	0,20	0,54	0,54	0,43	0,40	0,03	0,80	0,84	0,62	0,48	0,28	0,64	0,18	0,56	0,67	0,40	0,67	0,17	0,15
0000-1138	0,02	0,64	0,75	0,82	0,81	0,85	0,82	0,82	0,82	0,82	0,09	0,04	0,64	0,79	0,85	0,51	0,21	0,56	0,52	0,30	0,63	0,73	0,51	0,27	0,11	0,54	0,41	0,35	0,44	0,33	0,33	0,70	0,20	0,30	0,20	0,77	0,07	0,10
0000-1155	0,01	0,30	0,80	0,80	0,60	0,80	0,80	0,80	0,80	0,80	0,73	0,00	0,80	0,80	0,80	0,37	0,23	0,43	0,33	0,27	0,57	0,77	0,70	0,63	0,03	0,55	0,40	0,36	0,43	0,31	0,48	0,50	0,00	0,43	0,00	0,86	0,09	0,14
0000-1177	0,04	0,78	0,86	0,86	0,86	0,86	0,86	0,86	0,86	0,86	0,05	0,03	0,86	0,86	0,88	0,68	0,63	0,78	0,54	0,42	0,59	0,81	0,36	0,29	0,14	0,71	0,44	0,34	0,63	0,50	0,49	0,20	0,50	0,15	0,00	0,88	0,09	0,24
0000-1188	0,02	0,53	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,91	0,00	0,96	0,91	0,96	0,69	0,37	0,91	0,74	0,74	0,91	0,94	0,70	0,52	0,00	0,37	0,21	0,15	0,21	0,19	0,21	0,71	0,00	0,33	0,00	0,84	0,04	0,26
0000-1212	0,04	0,73	0,92	0,92	0,89	0,92	0,92	0,92	0,92	0,92	0,88	0,03	0,92	0,88	0,92	0,68	0,43	0,68	0,55	0,46	0,71	0,81	0,63	0,62	0,04	0,54	0,37	0,39	0,38	0,34	0,40	0,68	0,04	0,38	0,04	0,77	0,06	0,19
0000-1225	0,01	0,11	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	0,00	0,67	0,67	0,67	1,00	0,67	0,67	0,33	0,33	0,67	0,67	0,67	0,67	0,67	0,00	0,36	0,67	1,00	1,00	1,00	0,00					1,00	0,00	0,29

practice_id	1a	1b	2a	2b	2c	2d	2e	2f	2g	2h	2i	2j	2k	2l	2m	2n	2o	2p	2q	2r	2s	2t	2u	2v	5,00	8,00	9a	9b	10a	10b	11,00	13,00	14,00	15,00	16,00	17,00	18,00	19,00
0000-1240	0,03	0,73	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,16	0,97	0,97	0,97	0,91	0,88	0,97	0,44	0,69	0,94	0,75	0,75	0,72	0,00	0,42	0,29	0,13	0,39	0,29	0,16	0,71	0,00	0,40		1,00	0,00	0,28
0000-1241	0,02	0,37	0,87	0,87	0,87	0,87	0,87	0,87	0,87	0,87	0,81	0,10	0,85	0,85	0,87	0,79	0,52	0,79	0,54	0,67	0,67	0,73	0,52	0,52	0,25	0,79	0,55	0,47	0,60	0,53	0,63	0,56	0,15	0,70	0,00	1,00	0,22	0,71
0000-1252	0,02	0,56	0,89	0,89	0,89	0,89	0,88	0,88	0,88	0,88	0,03	0,76	0,88	0,66	0,87	0,60	0,51	0,73	0,51	0,34	0,81	0,71	0,61	0,47	0,01	0,46	0,22	0,13	0,34	0,17	0,29	0,75	0,00	0,00	0,00	0,76	0,01	0,22
0000-1254	0,02	0,54	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,91	0,90	0,01	0,91	0,90	0,91	0,81	0,34	0,65	0,40	0,39	0,77	0,74	0,61	0,46	0,13	0,70	0,52	0,38	0,33	0,27	0,58	0,50	0,07	0,17	0,10	0,81	0,04	0,25
0000-1259	0,02	0,48	0,93	0,93	0,89	0,94	0,94	0,94	0,94	0,93	0,23	0,41	0,93	0,94	0,95	0,57	0,55	0,65	0,39	0,25	0,55	0,67	0,41	0,24	0,14	0,65	0,44	0,38	0,33	0,22	0,51	0,38	0,14	0,40	0,29	0,58	0,02	0,14
0000-1270	0,02	0,50	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,50	0,05	0,75	0,55	0,70	0,65	0,65	0,70	0,65	0,25	0,80	0,65	0,30	0,20	0,00	0,62	0,57	0,33	0,65	0,13	0,35	1,00		0,50		0,92	0,05	0,13
0000-1291	0,02	0,58	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,38	0,04	0,79	0,87	0,91	0,51	0,33	0,66	0,66	0,44	0,69	0,90	0,77	0,73	0,05	0,58	0,40	0,32	0,34	0,32	0,38	0,80	0,07	0,50	0,00	0,69	0,03	0,11
0000-1317	0,02	0,63	0,89	0,89	0,88	0,88	0,88	0,88	0,88	0,88	0,02	0,27	0,88	0,27	0,91	0,75	0,50	0,53	0,28	0,39	0,77	0,81	0,38	0,19	0,01	0,45	0,34	0,24	0,34	0,19	0,16	0,25	0,17	0,25	0,50	0,82	0,02	0,14
0000-1329	0,03	0,86	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,92	0,00	0,86	0,92	0,87	0,91	0,61	0,39	0,75	0,28	0,35	0,70	0,85	0,46	0,40	0,07	0,64	0,31	0,30	0,40	0,40	0,51	0,60	0,07	0,42	0,33	0,91	0,05	0,34
0000-1336	0,03	0,73	0,89	0,88	0,89	0,89	0,88	0,88	0,88	0,88	0,05	0,24	0,70	0,82	0,83	0,79	0,78	0,60	0,21	0,22	0,88	0,85	0,82	0,80	0,49	0,52	0,29	0,23	0,33	0,26	0,34	0,48	0,18	0,50	0,07	0,97	0,28	0,13
0000-1360	0,03	0,70	0,93	0,93	0,93	0,94	0,94	0,94	0,94	0,93	0,82	0,17	0,92	0,82	0,93	0,76	0,71	0,77	0,84	0,65	0,85	0,89	0,88	0,56	0,05	0,75	0,50	0,60	0,56	0,61	0,60	0,41	0,22	0,60	0,36	0,93	0,02	0,44
0000-1372	0,01	0,67	0,90	0,90	0,86	0,90	0,90	0,90	0,90	0,90	0,07	0,10	0,76	0,83	0,88	0,55	0,26	0,57	0,31	0,31	0,60	0,71	0,43	0,40	0,07	0,52	0,42	0,56	0,36	0,46	0,39	1,00	0,00	0,00	0,00	0,60	0,00	0,13
0000-1395	0,02	0,65	0,88	0,88	0,74	0,88	0,88	0,88	0,88	0,88	0,78	0,12	0,79	0,75	0,88	0,45	0,34	0,61	0,33	0,26	0,48	0,80	0,32	0,32	0,07	0,56	0,40	0,43	0,40	0,25	0,38	0,57	0,00	0,33	0,25	0,50	0,11	0,17
0000-1396	0,03	0,62	0,83	0,81	0,81	0,83	0,81	0,81	0,81	0,81	0,03	0,78	0,83	0,78	0,83	0,63	0,47	0,60	0,43	0,35	0,72	0,72	0,62	0,61	0,03	0,44	0,23	0,17	0,37	0,22	0,31	0,65	0,15	0,68	0,29	0,81	0,06	0,17
0000-1427	0,02	0,73	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,96	0,02	0,00	0,93	0,02	0,98	0,71	0,42	0,64	0,91	0,33	0,80	0,87	0,87	0,47	0,02	0,62	0,46	0,17	0,48	0,40	0,42	0,64	0,11	0,20	0,11	0,83	0,00	0,09
0000-1437	0,02	0,50	0,83	0,86	0,79	0,81	0,81	0,81	0,81	0,81	0,19	0,81	0,81	0,43	0,81	0,43	0,40	0,62	0,45	0,24	0,71	0,79	0,76	0,38	0,01	0,84	0,42	0,48	0,45	0,71	0,72	0,00	0,50		0,20	1,00	0,04	0,09
0000-1452	0,03	0,73	0,99	0,97	0,99	0,99	0,97	0,97	0,97	0,97	0,90	0,46	0,99	0,96	0,99	0,63	0,47	0,89	0,63	0,43	0,67	0,94	0,77	0,46	0,03	0,66	0,52	0,58	0,61	0,68	0,39	0,33	0,33	0,43	0,50	0,71	0,05	0,33
0000-1455	0,03	0,57	0,95	0,95	0,92	0,93	0,93	0,93	0,93	0,93	0,01	0,27	0,93	0,30	0,94	0,79	0,56	0,86	0,77	0,49	0,93	0,92	0,90	0,27	0,18	0,52	0,42	0,28	0,39	0,40	0,33	0,67	0,05	0,62	0,00	1,00	0,02	0,24
0000-1461	0,02	0,61	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,77	0,09	0,80	0,71	0,97	0,63	0,57	0,89	0,57	0,31	0,63	0,89	0,89	0,89	0,00	0,73	0,58	0,65	0,62	0,53	0,45	0,60	0,67	0,60	0,25	0,86	0,02	0,13
0000-1471	0,05	0,74	0,92	0,92	0,88	0,92	0,92	0,92	0,92	0,92	0,61	0,31	0,92	0,69	0,92	0,87	0,64	0,71	0,44	0,50	0,83	0,72	0,74	0,64	0,09	0,73	0,43	0,36	0,52	0,43	0,64	0,62	0,24	0,57	0,27	0,97	0,02	0,43
0000-1474	0,01	0,33	0,87	0,87	0,87	0,87	0,87	0,87	0,87	0,87	0,13	0,87	0,87	0,13	0,87	0,67	0,60	0,40	0,67	0,20	0,73	0,87	0,87	0,33	0,03	0,54	0,22	0,27	0,28	0,18	0,38	0,00	0,50	0,50	1,00	1,00	0,03	0,23
0000-1479	0,03	0,57	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,94	0,10	0,38	0,94	0,46	0,94	0,85	0,81	0,83	0,79	0,60	0,88	0,92	0,85	0,44	0,01	0,69	0,42	0,51	0,50	0,62	0,48	0,58	0,13	0,60	0,25	1,00	0,36	0,26
0000-1480	0,01	0,19	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,50	0,30	0,85	0,65	0,90	0,70	0,60	0,80	0,75	0,45	0,75	0,80	0,80	0,60	0,00	0,49	0,40	0,50	0,42	0,57	0,29	0,50	0,50	0,60		1,00	0,00	0,39
0000-1486	0,02	0,57	0,95	0,95	0,94	0,95	0,95	0,95	0,95	0,95	0,94	0,27	0,94	0,27	0,94	0,75	0,62	0,65	0,59	0,44	0,48	0,56	0,37	0,37	0,11	0,76	0,64	0,56	0,46	0,38	0,53	0,23	0,67	0,00	0,14	1,00	0,02	0,23
0000-1498	0,04	0,73	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,78	0,42	0,90	0,83	0,95	0,87	0,52	0,69	0,44	0,55	0,82	0,72	0,66	0,49	0,20	0,65	0,33	0,29	0,32	0,25	0,54	0,59	0,11	0,54	0,32	0,93	0,11	0,38

Appendix 5: Contacts with promotor

Contact moment 1: 12/01/2024

- Introduction to promotor
- Review of the different submitted topics and selection of a clinically relevant paper.
- Decision to further develop a previous paper by translating quality indicators into usable queries.

Contact moment 2: 20/03/2024

- Meeting with Professor Vaes and the authors of the previous master's thesis. We gained more insight into the previous paper.
- Further agreements were made regarding the next steps of the project, including reviewing the literature and drafting an initial list of queries.

Contact moment 3: 12/11/2024

- Discussion of the analysis of the quality indicators and the objective of translating them into queries.
- We received feedback on feasibility and usability.

Contact moment 4: 26/02/2025

- Discussion of the first version of the developed queries and identification of areas requiring further content-related or technical refinement.
- Introduction to the statisticians regarding the processing of the queries and their calculation within Intego.

Contact moment 5: 17/07/2025

- Fine-tuning of the queries following feedback from Professor Vaes and the statisticians.

Contact moment 6: 16/09/2025

- Preparation of the queries for the official start of the statistical analysis.

Contact moment 7: 11/11/2025

- Start of the statistical analysis within Intego.

Contact moment 8: 21/03/2026

- Feedback on the processing of the statistical results.

Contact moment 9: 18/04/2026

- Discussion of the further refinement of the discussion and abstract.
- Final feedback was given to allow independent completion of the paper.

Regular contact via email

- Regular email exchanges with Professor Vaes regarding specific questions, clarification of technical aspects, and updates on progress.