

Supplementary

Criteria considered for gout diagnosis	Included for gout diagnosis	Excluded following exploratory phase
1. Problem list of the EHR (independent of the ICD-10-GM code)	Regular expression query in full text for: <ul style="list-style-type: none"> “gout”, “podagra”, “tophus”, “tophi”, “tophaceous”[†] 	Exclusion of problems using a defined set of regular expression [§]
2. Joint aspiration result	Presence of monosodium urate crystals	None
3. ICD-10-GM diagnosis code	M10.00-M10.99: gout	M11.X: other crystal arthropathies
4. Drugs <ul style="list-style-type: none"> Prescription of urate lowering therapy (ULT) Prescription form containing an ULT 	At least one of: <ul style="list-style-type: none"> Allopurinol (ATC: M04AA01) Febuxostat (ATC: M04AA03) Probenecid (ATC: M04AB01) Lesinurad (ATC: M04AB05) 	Prescription of an ULT and presence of at least one of the following ICD-10 GM code at any time: C81 to C96: Malignant neoplasms, stated or presumed to be primary, of lymphoid, haematopoietic and related tissue
5. Documents <ul style="list-style-type: none"> Inpatient report (Admission or discharge letter from any type of care) Outpatient report (emergency room, specialist consultation) 	Regular expression query in full text for: <ul style="list-style-type: none"> “gout”, “podagra”, “tophus”, “tophi”, “tophaceous”[†] 	Exclusion of documents using a defined set of regular expression [§]
6. Imaging report <ul style="list-style-type: none"> X-ray ultrasound dual-energy computed tomogram 	Regular expression query for the following words: <ul style="list-style-type: none"> “gout”, “podagra”, “tophus”, “tophi”, “tophaceous”, “double contour”[†] 	Exclusion of documents using a defined set of regular expression [§]

Supplementary table 1 : Variables and criterion used to assess gout diagnosis. *Benzbromarone isn't authorized on the Swiss market. Lesinurad was pulled out of the market in 2021. Rasburicase isn't authorized for chronic gout treatment. † French translation of the original words used are described in the supplementary table 3. § the R code, as well as a working example has been made available here:

https://gitlab.unige.ch/goutte/register_validation. ICD-10-GM: German Modifications of the International Classification of Diseases, 10th revision ATC: Anatomical Therapeutic Chemical Classification

Combination		Variables considered for risk factors	Criterion for gout risk factors (and ICD-10 GM codes)
AND		Sex and age	Women \geq 65 years old Men \geq 40 years old
AND		BMI	$> 25 \text{ kg/m}^2$
AND	OR	Uricaemia	Serum urate $> 500 \text{ }\mu\text{mol/l}$ (8.4 mg/dl)
	OR	Chronic kidney disease	N18.X Problem list: Chronic kidney disease G3a or worse (including dialyses)
	OR	Metabolic syndrome	<ul style="list-style-type: none"> • Diabetes or glucose intolerance (E10.X to E14.X, R73.X) • Hypertension (I10.X to I15.X) • Dyslipidaemia (E78.x) • BMI $> 30 \text{ kg/m}^2$
	OR	Myocardial infarction	I21.X to I25.X
	OR	Lifestyle at risk to develop a gout	Deleterious use of alcohol (F10.1, F10.2, F10.3)

Supplementary table 2: Variables and criteria used to assess gout risk factors.

Category	Variables
Anthropometric & demographic data	Age Sex Weight Height BMI First language Country of residency Nationality Insurance class Living/death status Marital status
Clinical pathway	Inpatient gout episode of care Outpatient gout episode of care Departments involved Duration of hospitalisation
Diagnosis	Main diagnosis (inpatient)
Comorbidities (ICD-10-GM diagnostic)	Number of comorbidities Individual comorbidities Hypertension and hypertensive diseases: <ul style="list-style-type: none"> • Essential hypertension: I10.00 – I10.91 • Hypertensive cardiopathy: I11.00 – I11.91 • Hypertensive nephropathy: I12.00 – I12.91 • Hypertensive cardioneuropathy: I13.00-I13.91 • Secondary hypertension: I15.00 – I15.91 Dyslipidaemia: <ul style="list-style-type: none"> • Disorders of lipoprotein metabolism and other lipidaemias: E78.0-E78.9 Diabetes <ul style="list-style-type: none"> • Type 1 diabetes: E10.01-E10.91 • Type 2 diabetes: E11.01 – E11.91 • Malnutrition diabetes: E12.11 – E12.91 • Other specified diabetes mellitus: E13.01 – E13.91 • Unspecified diabetes mellitus: E14.01 – E14.91 Cardiovascular and ischaemic heart disease: <ul style="list-style-type: none"> • Angina pectoris: I20.00-I20.9 • Acute myocardial infarction: I21.0 – I21.9 • Recurring myocardial infarction: I22.0-I22.9 • Complication of a myocardial infarction: I23.0 – I23.8 • Other ischaemic cardiopathy: I24.0-I24.9 • Chronic ischaemic cardiopathy: I25.0-I25.9 • Cerebral infarction: I63.0 – I63.9 • Stroke, not specified: I64

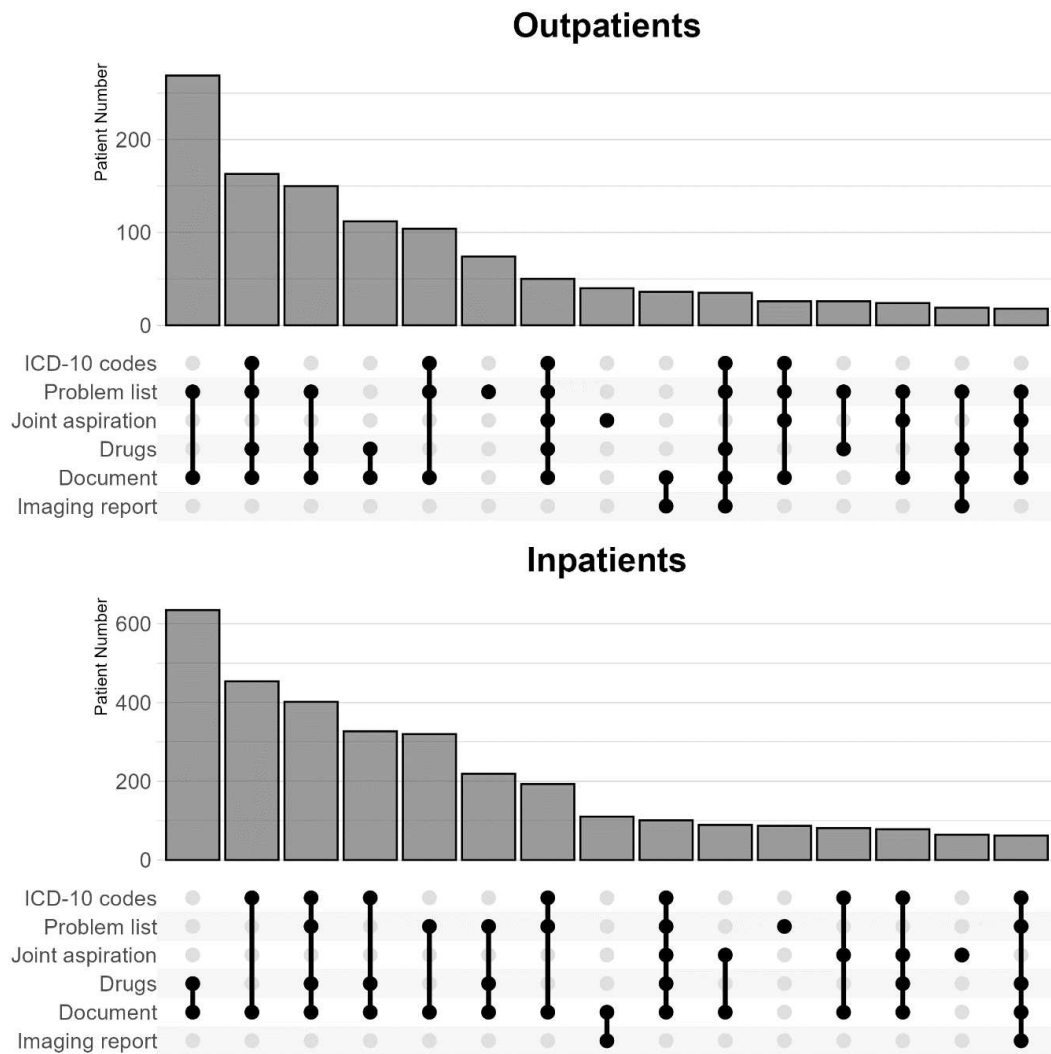
	<ul style="list-style-type: none"> • Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction: I65.0 – I65.9 • Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction: I66.0-I66.9 • Sequelae of cerebrovascular disease: I69.0 – I69.8 • Atherosclerosis: I70.0 – I70.9 • Arterial embolism and thrombosis: I74.0 – I74.9 • Heart failure: I50.0 – I50.9 <p>Chronic kidney disease (stage ≥ 3): N18.3 – N18.9 Diseases of liver: K70-K77.8 Psychiatric disorders: F00-F99 Transplanted organ and tissue status: Z94.0 – Z94.9 Malignancies: C00-C97 Disorders of purine and pyrimidine metabolism: E79.1-E79.9</p>
Laboratory data	<p>Serum urate value Serum creatinine and eGFR CRP Erythrocyte sedimentation rate Liver function tests Blood cell count</p>
Joint puncture	<p>Joint Number of joint aspiration Volume of synovial fluid Presence of bacteriologic exam, Result of bacteriologic exam Presence of cell count Result of cell count Presence of crystal evaluation Crystal type in joint aspiration</p>
Chronic drug treatment	<p>Allopurinol Febuxostat Probenecid Lesinurad Rasburicase</p>
Drug prophylaxis during initiation of ULT	<p>Colchicine Corticosteroid NSAID</p>
Acute flare treatment	<p>Colchicine Intra-articular corticoid injection (triamcinolone acetonide, betamethasone, triamcinolone hexacetonide) Oral, IV or IM corticoid (dexamethasone, prednisone, methylprednisolone, prednisolone) Anakinra or canakinumab NSAID</p>
Gout predisposing drugs	<p>Aspirin Ciclosporin</p>

	Tacrolimus Loop diuretics (furosemid, torasemid) Thiazide diuretics (hydrochlorothiazide) Thiazide-like diuretics (metolazone, indapamide, chlorthalidone)
Gout protecting drugs	Fenofibrate Losartan SGLT-2 inhibitors
Pain score	Visual analog scale
Fall	Fall event during an acute gout flare ("déclaration de chute")
Rheumatology consultation	Presence or absence
Imaging	Presence of an X-ray of the painful articulation Presence of a CT dual energy of the painful articulation Presence of an ultrasound of the painful articulation Gout-related damage or tophi or double contour sign

Supplementary Table 3: Data extracted from the electronic health record.

Query	French translation	English translation
Documents	<ul style="list-style-type: none"> • « goutte » • « podagre » • « tophus » • « tophi » • « tophacée » 	<ul style="list-style-type: none"> • Gout • Podagra • Tophus • Tophi • Tophaceous
Search in the problem list of the EHR (independent of the ICD-10-GM code)	<ul style="list-style-type: none"> • « goutte » • « goutteux » • « goutteuse » • « podagra » • « tophus » • « tophi » • « tophacée » 	<ul style="list-style-type: none"> • Gout • Gouty • Gouty • Podagra • Tophus • Tophi • Tophaceous
Imaging report	<ul style="list-style-type: none"> • « goutte » • « podagre » • « tophus » • « tophi » • « tophacée » • « double-contour » 	<ul style="list-style-type: none"> • Gout • Podagra • Tophus • Tophi • Tophaceous • Double contour

Supplementary table 4: original translation of the words used in the queries to detect gout patients.



Supplementary Figure 1A and 1B: Upset-plot of the six queries identifying gout patients in the electronic health record of the Geneva University Hospital when using a combination of criteria (Problem list OR Aspiration OR ≥ 2 other criteria) and by setting stratification. Rare combinations of criteria were not displayed. ICD-10-GM diagnoses are coded only during an inpatient stay

Criterion present alone	Total	Gout	No gout	Equivocal	Positive predictive value (CI 95%)
Problem list	8	7	1	0	87.5% (52.9-99.4)
Aspirations	6	4	2	0	66.7% (30.0-90.3)
ICD-10-GM Codes	5	2	3	0	40.0% (11.8-76.9)
Drugs	178	58	28	92	32.6% (26.1-39.8)
Documents	143	84	55	4	58.7% (50.5-66.5)
Radiology reports	9	2	5	2	22.2% (6.3-54.7)

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Supplementary table 5 : Absolute numbers of patients and positive predictive value (PPV) of each criterion alone (a patient is detected only by the criterion). PPV was calculated by considering gout present versus gout absent or equivocal meaning equivocal cases were classified as non-gout in the PPV analysis.

Query (inpatients)	Total	Gout	No gout	Equivocal	Positive predictive value (CI 95%)
Present irrespective of other criteria					
Problem list	75	74	1	0	98.7% (92.8-99.9)
Joint aspiration	38	37	1	0	97.4% (86.5-99.9)
ICD-10-GM Codes	96	89	6	1	92.7% (85.7-96.4)
Drugs	208	202	1	5	97.1% (93.9-98.7)
Documents	167	156	8	3	93.4% (88.6-96.3)
Radiology reports	24	24	0	0	100.0% (86.2-100.0)
Present alone					
Problem list	4	4	0	0	100.0% (51.0-100.0)
Joint aspiration	5	4	1	0	80.0% (37.6-99.0)
ICD-10-GM Codes	0	0	0	0	
Drugs	0	0	0	0	
Documents	0	0	0	0	
Radiology reports	0	0	0	0	
Combination query					
Problem or joint aspirations or ≥ 2 other criteria	180	168	9	3	93.3% (88.7-96.1)

Supplementary table 6: Positive predictive value according to each query and a combination of queries, among 180 inpatients PPV.

Query (outpatients)	Total	Gout	No gout	Equivocal	Positive predictive value (CI 95%)
Present irrespective of other criteria					
Problem list	66	63	3	0	95.5% (87.5-98.4)
Joint aspiration	10	9	1	0	90.0% (59.6-99.5)
ICD-10-GM Codes	31	30	1	0	96.8% (83.8-99.8)
Drugs	76	76	0	0	100.0% (95.2-100.0)
Documents	73	67	5	1	91.8% (83.2-96.2)
Radiology reports	14	10	3	1	71.4% (45.4-88.3)
Present alone					
Problem list	4	3	1	0	75.0% (30.1-98.7)
Joint aspiration	1	0	1	0	0.0% (0.0-94.9)
ICD-10-GM Codes	0	0	0	0	
Drugs	0	0	0	0	
Documents	0	0	0	0	
Radiology reports	0	0	0	0	
Combination query					
Problem or joint aspirations or ≥ 2 other criteria	82	74	7	1	90.2% (81.9-95.0)

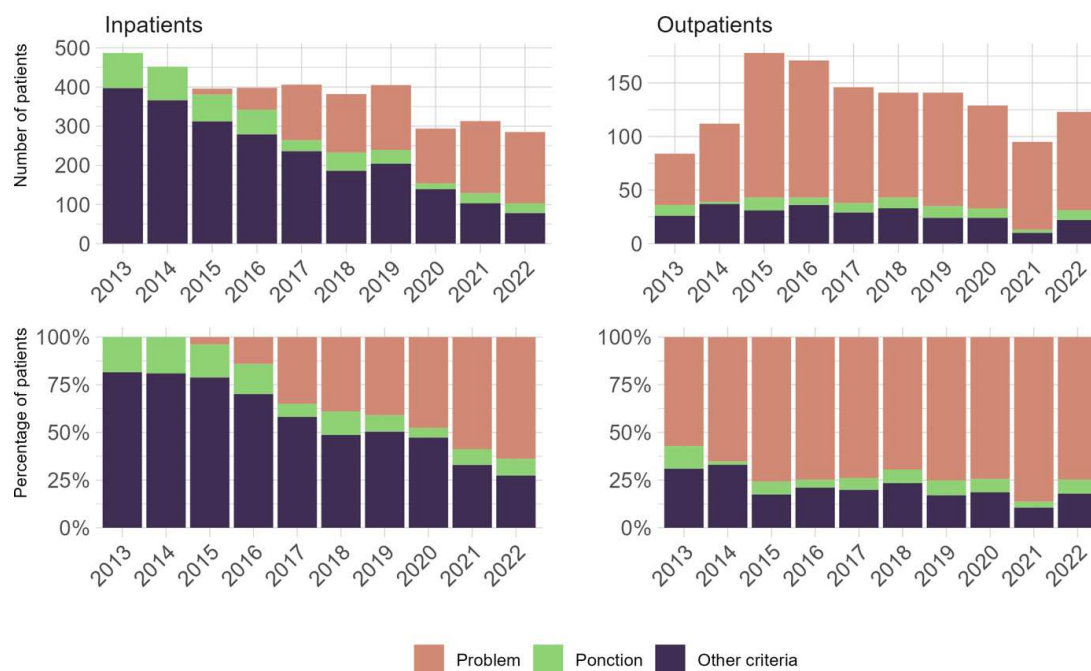
Supplementary table 7: Positive predictive value according to each query and a combination of queries, among 82 outpatients PPV. ICD-10-GM codes are not available for inpatient.

Risk factor	Overall	Alcohol	MI	CKD	MS	Uricaemia
Characteristics						
Total number	15646	3249	4818	4188	1906	1485
Age (mean (SD))	73.09 (13.2)	65.80 (13.2)	73.68 (13.0)	79.33 (11.1)	71.75 (10.8)	71.22 (13.6)
BMI (mean (SD))	33.78 (28.7)	32.56 (25.9)	32.85 (29.2)	33.69 (29.7)	38.80 (32.8)	33.27 (22.6)
Number of death (%) at 31.12.2022	6567 (42.0)	1051 (32.3)	1882 (39.1)	2314 (55.3)	622 (32.6)	698 (47.0)
Detected by the register (%)	2588 (16.5)	362 (11.1)	524 (10.9)	817 (19.5)	287 (15.1)	598 (40.3)

Supplementary Table 8: Absolute number of patients with risk factor for gout, their characteristics and number of patients detected by our algorithm detecting gout patients. MI: myocardial infarction. CKD: chronic kidney disease. MS: Metabolic syndrome. BMI: body mass index

Criterion present alone	Total	Gout	No gout	Equivocal	Negative predictive value (CI 95%)
Uricaemia > 500 $\mu\text{mol/l}$	22	6	16	0	72.7% (51.8 to 86.8)
Chronic kidney disease	86	5	79	2	91.9% (84.1 to 96.0)
Metabolic syndrome	39	3	36	0	92.3% (79.7 to 97.3)
Myocardial infarction	128	1	126	1	98.4% (94.5 to 99.6)
Deleterious use of alcohol	107	2	104	1	97.2% (92.1 to 99.0)

Supplementary table 9 : Absolute numbers of patients and negative predictive value (NPV) of each criterion alone (a patient is detected only by the criterion). NPV was calculated by considering gout present versus gout absent or equivocal meaning equivocal cases were classified as gout in the NPV analysis.



Supplementary figure 2: Evolution of gout diagnostic according to the criterion or combination of criteria to establish the diagnosis at first detection in the register (or second in case of query combination). Other criteria correspond to a combination of ≥ 2 criterion among the documents, ICD-10-GM codes, imaging reports and drugs queries.

Department	Units
Medicine	<ul style="list-style-type: none"> • cardiology • angiology & hemostasis • dermatology & venereal disease • diabetes, endocrinology & nutrition gastro- enterology & hepatology • immunology & allergology • infectious diseases • bone disease • nephrology & hypertension • internal medicine • pneumology • rheumatology
Geriatrics	<ul style="list-style-type: none"> • Geriatrics & Readaptation • Old age internal medicine • Palliative medicine • Memory center
Surgery	<ul style="list-style-type: none"> • cardiovascular surgery • maxilo-facial & oral surgery • orthopedics & traumatology

	<ul style="list-style-type: none"> • plastic & reconstructive surgery • thoracic & endocrine surgery • visceral surgery • transplantation • urology
Acute medicine	<ul style="list-style-type: none"> • Anesthesiology • intensive care • pharmacology & toxicology • emergency units
Primary care	<ul style="list-style-type: none"> • Primary care • Legal medicine
Psychiatry	<ul style="list-style-type: none"> • Adult psychiatry • Geriatric psychiatry • Addiction unit • Liaison psychiatry
Other	<ul style="list-style-type: none"> • Neurosurgery • Neurology • Neuro-rehabilitation • Ophthalmology • ear, nose and throat & cervico-facial surgery units. • Pathology • Laboratory • Radiology • Gynecology & obstetrics • Paediatrics

Supplementary table 10 : Departments of the Geneva University Hospitals and their units