

# ChatGPT και Εφαρμογές AI για Ιατρούς

## 1<sup>th</sup> session – **Electronic Health Records Management and MIMIC III Medical Dataset**

UNIVERSITY OF THE  
**AEGEAN**



SCHOOL OF ENGINEERING  
DEPARTMENT OF INFORMATION  
AND COMMUNICATION  
SYSTEMS ENGINEERING

**Presenter:** Panagiotis Symeonidis

Associate Professor

<http://panagiotissymeonidis.com>

[psymeon@aegean.gr](mailto:psymeon@aegean.gr)

<https://ehealth.gov.gr/>



govgr BETA

Ατομικά Στοιχεία

Άυλη Συνταγογράφηση

Νέο Ραντεβού

Εφαρμογή Προσωπικού Ιατρού



Ηλεκτρονικός Φάκελος Υγείας ▾ Με μια ματιά

# ΗΛΕΚΤΡΟΝΙΚΟΣ ΦΑΚΕΛΟΣ ΥΓΕΙΑΣ ΑΣΘΕΝΟΥΣ → ΦΑΡΜΑΚΑ (9/14)

ATC Κωδικός	Εμπορική Ονομασία	Δραστική Ουσία	Μονάδα	Μορφή Δόσης	Συχνότητα	Διάρκεια (Ημ)	Ημερομηνία	Προέλευση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	30/09/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	30/09/2024	Συνταγογράφηση
A02BC03	LAPRAZOL FAST TAB OR.DISPTA 30MG/TAB BT x 28	LANSOPRAZOLE	1	ΔΙΣΚΙΑ ΔΙΑΣΠ	1 φορά την ημέρα	30	20/09/2024	Συνταγογράφηση
C10AA05	HOLISTEN F.C.TAB 20MG/TAB BTx30 (BLISTER3x10)	ATORVASTATIN CALCIUM TRIHYDRATE	-	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	-	-	26/08/2024	Ατομικό Ιστορικό
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	30/07/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	03/06/2024	Συνταγογράφηση
M01AE01	ALGOFREN F.C.TAB 600MG/TAB BTx20 (BLIST 2x10)	IBUPROFEN	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	3	31/05/2024	Συνταγογράφηση
J01CR02	AUGMENTIN F.C.TAB (875+125)MG/TAB BTx12	AMOXICILLIN TRIHYDRATE,CLAVULANATE POTASSIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	5	31/05/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	14/05/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	08/04/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	29/03/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	05/02/2024	Συνταγογράφηση
J01FA09	CLARIPEN F.C.TAB 500MG/TAB BTx 21 (BLIST 3 x7)	CLARITHROMYCIN	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	10	24/01/2024	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	30	20/10/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	30	20/10/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	30	15/09/2023	Συνταγογράφηση
J01FA09	CLARIPEN F.C.TAB 500MG/TAB BTx 21 (BLIST 3 x7)	CLARITHROMYCIN	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	6	20/07/2023	Συνταγογράφηση
R01AD05	AURID NASPR.SUS 100MCG/DOSE FLX10ML(200DOSES)	BUDESONIDE	1	ΡΙΝΙΚΟ ΣΠΡΑΥ ΔΟΣΕΙΣ	2 φορές την ημέρα	15	20/07/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	30	20/07/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	30	04/07/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	30	26/05/2023	Συνταγογράφηση
J01FA09	CLARIPEN F.C.TAB 500MG/TAB BTx 21 (BLIST 3 x7)	CLARITHROMYCIN	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	2 φορές την ημέρα	6	19/04/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 5MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	19/04/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	16/01/2023	Συνταγογράφηση
C10AA07	PLATOREL F.C.TAB 20MG/TAB BTx30	ROSUVASTATIN CALCIUM	1	ΔΙΣΚΙΑ ΕΠΙΚΑΛ	1 φορά την ημέρα	30	12/12/2022	Συνταγογράφηση

# ΗΛΕΚΤΡΟΝΙΚΟΣ ΦΑΚΕΛΟΣ ΥΓΕΙΑΣ ΑΣΘΕΝΟΥΣ → ΕΓΓΡΑΦΑ (13/14)

Επισκέψεις	Ραντεβού	Υ Παιδιατρικό Ιστορικό (Η.Β.Υ.Π)	Ατομικό Ιστορικό	Υ Οικογενειακό Ιστορικό	Διαγνώσεις	Φάρμακα	Εξετάσεις	Εμβόλια	Νοσηλεία
Τύπος Εγγράφου	Ημερομηνία Εισαγωγής	Όνομα Αρχείου	Περιγραφή Εγγράφου				Προέλευση Αρχε		
▼ Εξετάσεις (Αποτε									
▼	05/10/2021	20211005_171331.pdf					Επίσκεψη		
			<div><p>Όνομασία Εγγράφου: 20211005_171331.pdf</p><p>Περιγραφή Εγγράφου: <input type="text"/></p><p>Ημερομηνία Εγγράφου: 5/10/2021</p><p>Πληροφορίες συντάκτη ιατρού (προαιρετικό)</p><p>ΑΜΚΑ: <input type="text"/> !</p><p>Όνοματεπώνυμο: <input type="text"/></p><p>* Πρέπει να επιλέξετε υποχρεωτικά τουλάχιστον μια από τις παρακάτω επιλογές:</p><p><input type="checkbox"/> Άλλο <input type="checkbox"/> Διαγνώσεις <input checked="" type="checkbox"/> Εξετάσεις (Αποτελέσματα) <input type="checkbox"/> Εξιτήρια (Νοσηλίες)</p><p><input type="checkbox"/> Πορίσματα <input type="checkbox"/> Πρακτικό Χειρουργείου <input type="checkbox"/> Φύλλο Ασθενούς ΤΕΠ</p><p>Ανάκτηση αρχείου Μέγεθος: 2 MB</p></div>						
▶	11/09/2018	20180911_160008.pdf					Επίσκεψη		
▶	12/08/2022	20220812_123033.pdf					Επίσκεψη		
▶	16/11/2022						Επίσκεψη		
▶	26/05/2023	20230526_105239.pdf					Επίσκεψη		
▶	22/07/2024	SKM_300i24072217311.					Επίσκεψη		
▶	26/08/2024						Επίσκεψη		

# MIMIC III Data set

- Beth Israel Deaconess Medical Center in Boston, Massachusetts
- 38,597 distinct adult patients
- 4,579 charted observations ('chartevents')
- 380 laboratory measurements ('labevents & inpuvents')
- Demographic, Procedures/Interventions, Medications
- Patient follow-up after discharge
- 44 GB of medical data!

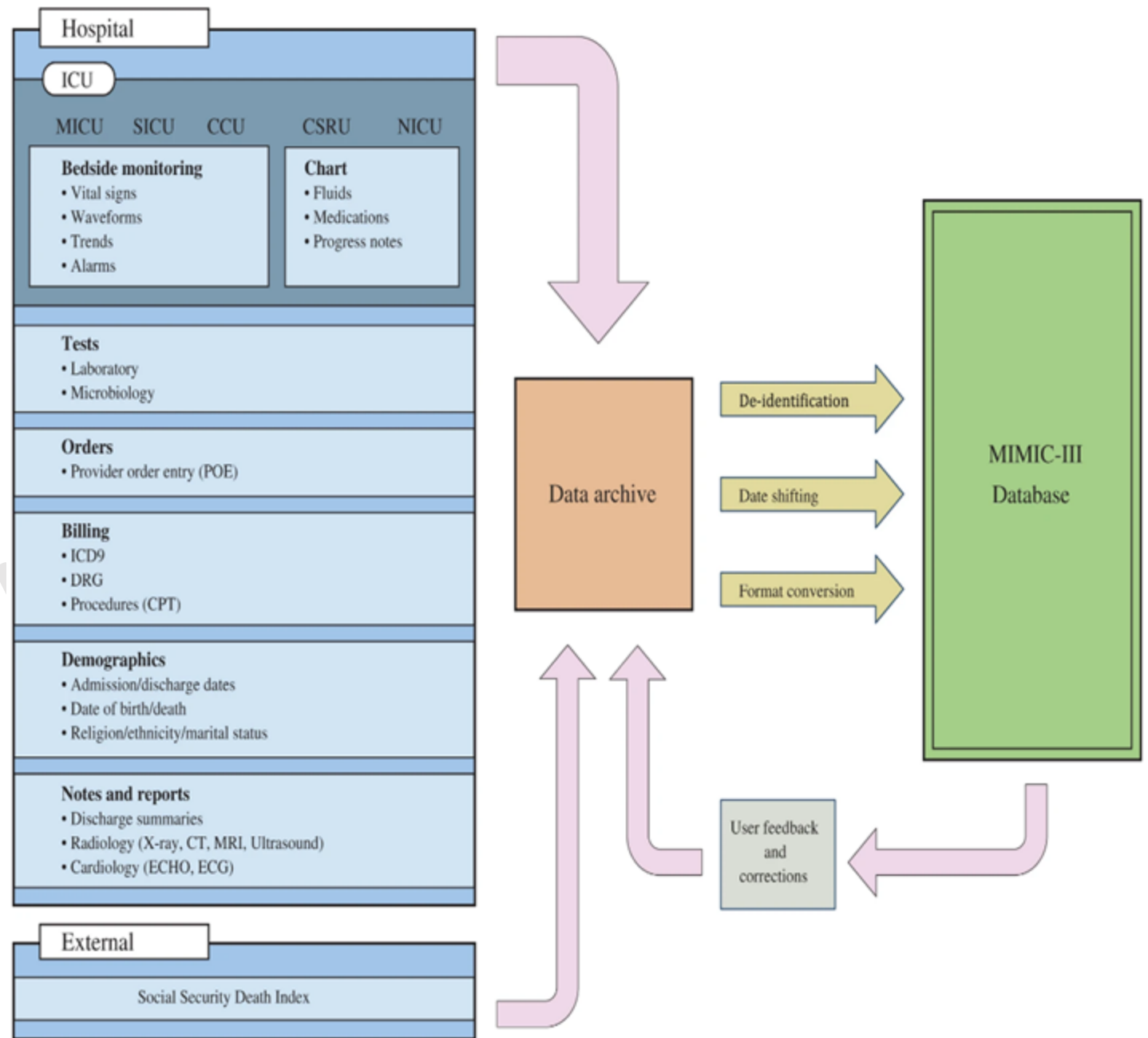
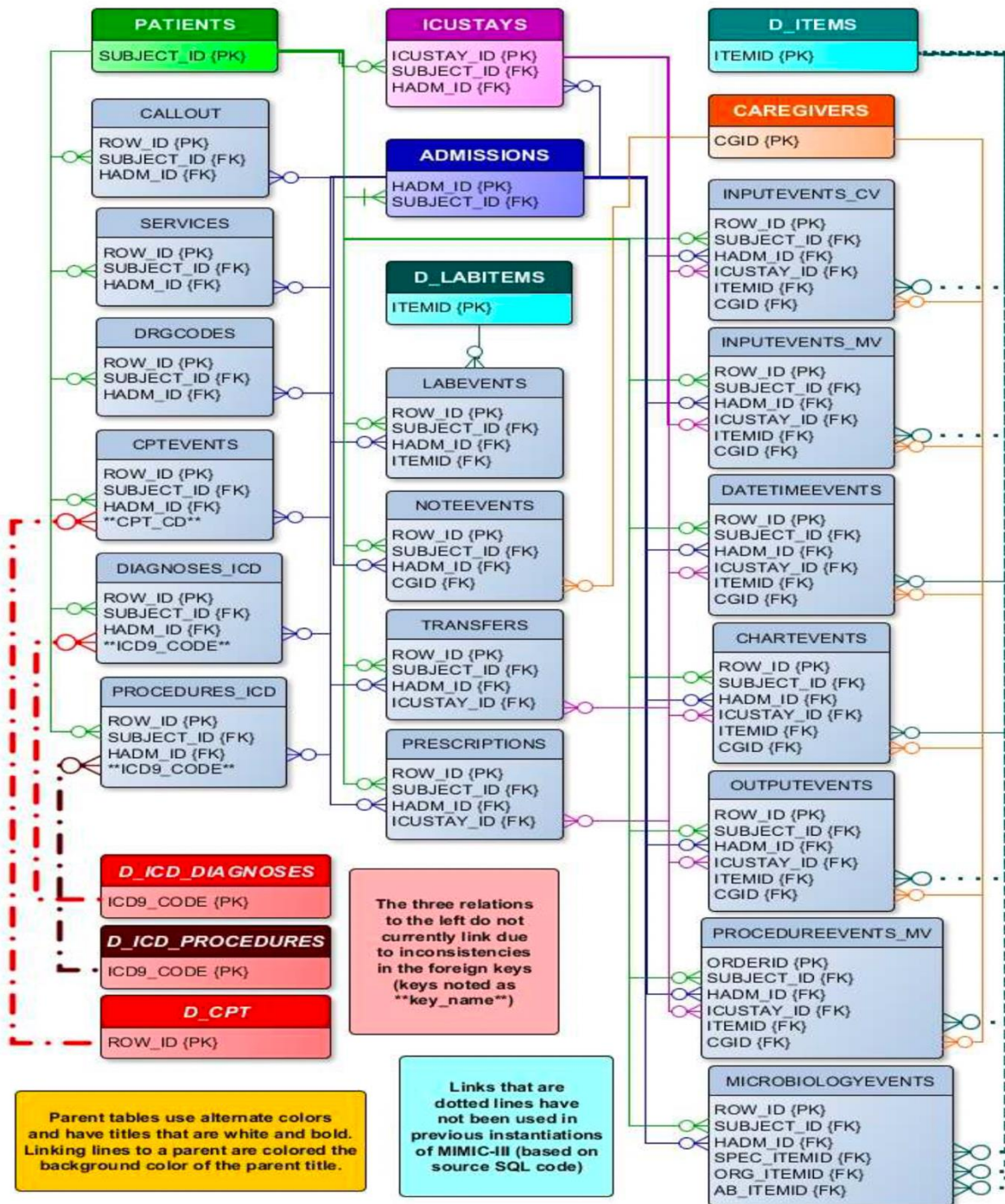


Figure 2: MIMIC-III Entity Relationship Class Diagram



# E-R Diagram of MIMIC III

Important considerations from the ER diagram ([Figure 2](#)):

- Only the attributes used as primary key and foreign key are listed in the ER diagram.
  - For a complete list of attributes, consult the [Data Dictionary](#).
- Finally, since the dataset is so large, it was impossible to refine the cardinality to know which one-to-many relationships are “zero or more” or “one or more” on the “many” side of the relationship. For purposes of the ER diagram, it was known that all patients have at least one admission, so the “one or more” relationship was used. For all other relationships, there is an assumption that there may be individual ICU stays that may not have data represented in some of the other tables even though, realistically, there are probably many more “one or more” notations that should have been used in the ER diagram.
  - As always, any errors in the above interpretations are the fault of this [document's author](#) alone.

Creation of the [Data Dictionary](#) was an important part of the conceptual understanding of the MIMIC-III database. With 324 different attributes in the 26 tables, much care was exercised for understanding the structure of the MIMIC-III database.

patients		
row_id		
subject_id		
gender		
dob		
dod		
dod_hosp		
dod_ssn		
expire_flag		
	46,520 rows	19 >

admissions		
row_id		
subject_id		
hadm_id		
admittime		
dischtime		
deathtime		
admission_type		
admission_location		
discharge_location		
insurance		
language		
religion		
marital_status		
ethnicity		
edregtime		
edouttime		
diagnosis		
hospital_expire_flag		
has_chartevents_data		
	< 1   58,976 rows   18 >	

icustays		
row_id		
subject_id		
hadm_id		
icustay_id		
dbsource		
first_careunit		
last_careunit		
first_wardid		
last_wardid		
intime		
outtime		
los		
	< 2   61,532 rows   8 >	

d_items		
row_id		
itemid		
label		
abbreviation		
dbsource		
linksto		
category		
unitname		
param_type		
conceptid		
	12,487 rows	8 >

caregivers		
row_id		
cgid		
label		
description		
	7,567 rows	7 >

chartevents		
row_id	int4[10]	
subject_id	int4[10]	
hadm_id	int4[10]	
icustay_id	int4[10]	
itemid	int4[10]	
charttime	timestamp[22]	
storetime	timestamp[22]	
cgid	int4[10]	
value	varchar[255]	
valuenum	float8[17,17]	
valueuom	varchar[50]	
warning	int4[10]	
error	int4[10]	
resultstatus	varchar[50]	
stopped	varchar[50]	
	< 5   330,712,483 rows	0 >

# Progress Notes for two patients



## MIMIC-III Clinical Database 1.4

File: <base> / NOTEEVENTS.csv.gz (1,165,661,335 bytes)

Download

ROW_ID	SUBJECT_ID	HADM_ID	CHARTDATE	CHARTTIME	STORETIME	CATEGORY	DESCRIPTION	CGID	ISERROR	TEXT
174	22532	167853	2151-08-04			Discharge summary	Report			Admission Date: [**2151-7-16**] Discharge Date: [**2151-8-4**]Service:ADDENDUM:RADIOLOGIC STUDIES: Radiologic studies also included a chestCT, which confirmed cavitory lesions in the left lung apexconsistent with infectious process/tuberculosis. This alsomoderate-sized left pleural effusion.HEAD CT: Head CT showed no intracranial hemorrhage or masseffect, but old infarction consistent with past medicalhistory.ABDOMINAL CT: Abdominal CT showed lesions ofT10 and sacrum most likely secondary to osteoporosis. These canbe followed by repeat imaging as an outpatient. [**First Name8 (NamePattern2) **] [**First Name4 (NamePattern1) 1775**] [**Last Name (NamePattern1) **], M.D. [**MD Number(1) 1776**]Dictated By:[**Hospital 1807**]MEDQUIST36D: [**2151-8-5**] 12:11T: [**2151-8-5**] 12:21JOB#: [**Job Number 1808**]
175	13702	107527	2118-06-14			Discharge summary	Report			Admission Date: [**2118-6-2**] Discharge Date: [**2118-6-14**]Date of Birth: Sex: FService: MICU and then to [**Doctor Last Name **] MedicineHISTORY OF PRESENT ILLNESS: This is an 81-year-old femalewith a history of emphysema (not on home O2), who presentswith three days of shortness of breath thought by her primarycare doctor to be a COPD flare. Two days prior to admission,she was started on a prednisone taper and one day prior toadmission she required oxygen at home in order to maintainoxygen saturation greater than 90%. She has also been onlevofloxacin and nebulizers, and was not getting better, andpresented to the [**Hospital1 18**] Emergency Room.In the [**Hospital3 **] Emergency Room, her oxygen saturation was100% on CPAP. She was not able to be weaned off of thisdespite nebulizer treatment and Solu-Medrol 125 mg IV x2.Review of systems is negative for the following: Fevers,chills, nausea, vomiting, night sweats, change in weight,gastrointestinal complaints, neurologic changes, rashes,palpitations, orthopnea. Is positive for the following:Chest pressure occasionally with shortness of breath with exertion, some shortness of breath that is positionallyrelated, but is improved with nebulizer treatment.PAST MEDICAL HISTORY:1. COPD. Last pulmonary function tests in [**2117-11-3**]demonstrated a FVC of 52% of predicted, a FEV1 of 54% ofpredicted, a MMF of 23% of predicted, and a FEV1:FVC ratio of67% of predicted, that does not improve with bronchodilatorreatment. The FVC, however, does significantly improve withbronchodilator treatment consistent with her known reversibleair flow obstruction in addition to an underlying restrictiveventilatory defect. The patient has never been on homeoxygen prior to this recent episode. She has never been onsteroid taper or been intubated in the past.2. Lacunar CVA. MRI of the head in [**2114-11-4**]demonstrates "mild degree of multiple small foci of high T2

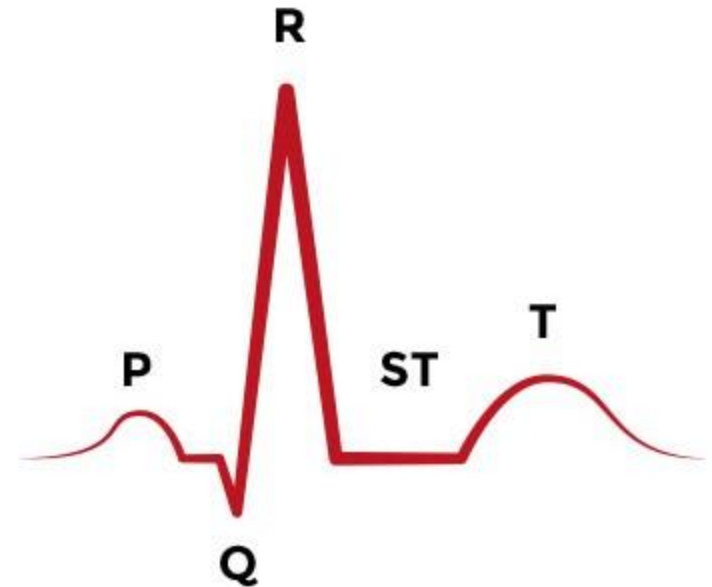
signal within the white matter of both cerebral hemispheres

as well as the pons in the latter region predominantly to

the right of midline. The abnormalities while nonspecific

# Introduction to Electrocardiograms (ECGs)

- ECGs are a non-invasive test to measure the electrical activity of the heart.
- They provide critical data to analyze heart conditions such as arrhythmias, heart attacks, and other cardiovascular issues.
- Widely used in healthcare for diagnostics and monitoring.



# Parameters' Selection Lists of our Application

Groups of Subject IDs  
All Subject IDs  
Subject IDs Diagnosed with Diabetes  
Rest Subject IDs

Subject IDs  
10017  
10264  
10424  
10629  
10633  
10731  
10806  
10967  
10976  
11003

Chart Events Labels  
Glucose  
Glucose (70-105)  
Art.pH  
Arterial BP Mean  
Arterial BP [Diastolic]  
Arterial BP [Systolic]  
Arterial Base Excess  
Arterial CO2(Calc)  
Arterial PaCO2  
Arterial PaO2

Location  
HOSPITAL  
ICU\_24H  
ICU\_AFTER\_24H

Age Range



# Software to filter patients by Disease Types using ICD-10 or ICD-9 diagnosis codes list

How to find a Patient with Diabetes Mellitus Disease, type II and with Peripheral Circulatory Disorder?

Search by Diseases

Icd9 Categories

- 238-Neoplasm of uncertain behavior of other and u
- 239-Neoplasm of unspecified nature
- 240-Simple and unspecified goiter
- 241-Nontoxic nodular goiter
- 242-Thyrotoxicosis with or without goiter
- 244-Acquired hypothyroidism
- 249-Secondary diabetes mellitus
- 250-Diabetes mellitus**
- 251-Other disorders of pancreatic internal secretior
- 252-Disorders of parathyroid gland

Diseases

- 25060 - Diabetes with neurological manifestations, type II or unspecified type, not stated as uncontrolled
- 25061 - Diabetes with neurological manifestations, type I [juvenile type], not stated as uncontrolled
- 25062 - Diabetes with neurological manifestations, type II or unspecified type, uncontrolled
- 25063 - Diabetes with neurological manifestations, type I [juvenile type], uncontrolled
- 25070 - Diabetes with peripheral circulatory disorders, type II or unspecified type, not stated as uncontrolled**
- 25071 - Diabetes with peripheral circulatory disorders, type I [juvenile type], not stated as uncontrolled
- 25072 - Diabetes with peripheral circulatory disorders, type II or unspecified type, uncontrolled

# Patient's Info

## PATIENT INFORMATION

Gender Female

Age 74 (hosp. entry)

Diabet. YES

Death AFTER ICU, 1199 days after ICU discharge

## Diseases

### DIAGNOSES

ICD9	DESCRIPTION
0380	Streptococcal septicemia
78552	Septic shock
5070	Pneumonitis due to inhalation of food or vomitus
5849	Acute kidney failure, unspecified
42731	Atrial fibrillation
1977	Malignant neoplasm of liver, secondary
1578	Malignant neoplasm of other specified sites of pancreas
2866	Defibrination syndrome
29590	Unspecified schizophrenia, unspecified
2764	Mixed acid-base balance disorder
99592	Severe sepsis
25070	Diabetes with peripheral circulatory disorders, type II or unspecified type, not stated as uncontrolled

## PATIENT INFORMATION

Gender Female

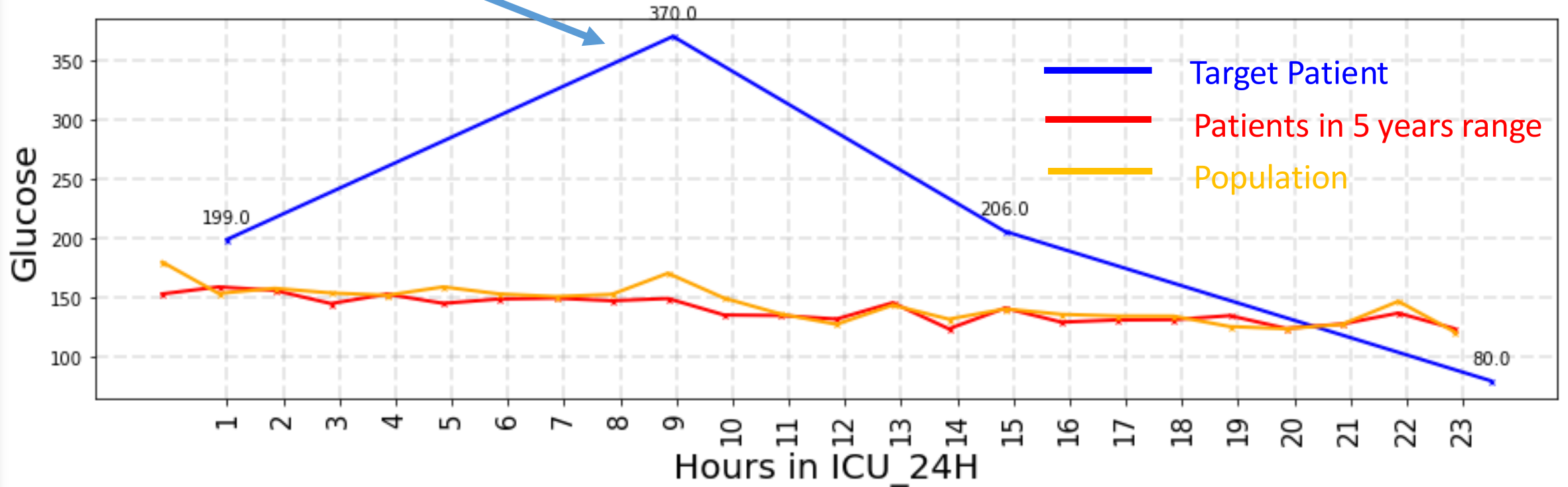
Age 74 (hosp. entry)

Diabet. YES

Death AFTER ICU, 1199 days after ICU discharge

Alerting doctors

## Glucose measurements



**PATIENT INFORMATION**

Gender Female

Age 74 (hosp. entry)

Diabet. YES

Death AFTER ICU, 1199 days after ICU discharge

# Insulin doses

**INPUTEVENTS**

TIME	ITEM	AMOUNT	AMOUNT UNITS	RATE	RATE UNITS
9.3 Hours after ICU entry	Insulin			8	Uhr
9.3 Hours after ICU entry	Insulin	0	U		
9.8 Hours after ICU entry	Insulin	3	U		
9.8 Hours after ICU entry	Insulin			10	Uhr
10.8 Hours after ICU entry	Insulin	10	U		
10.8 Hours after ICU entry	Insulin			12	Uhr
11.8 Hours after ICU entry	Insulin			10	Uhr
11.8 Hours after ICU entry	Insulin	12	U		
12.8 Hours after ICU entry	Insulin			12	Uhr
12.8 Hours after ICU entry	Insulin	10	U		
13.8 Hours after ICU entry	Insulin	12	U		

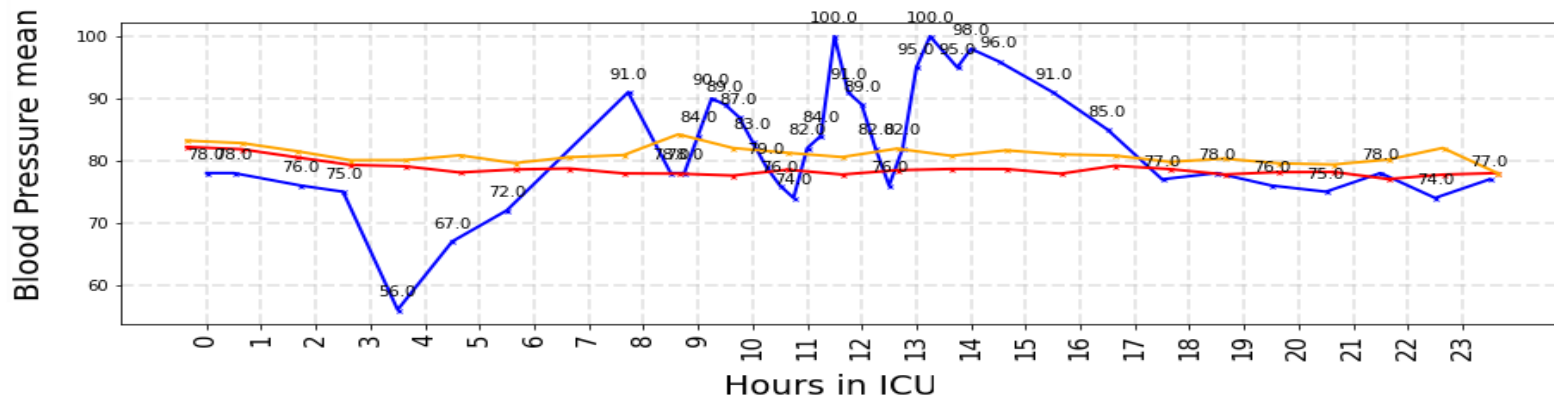
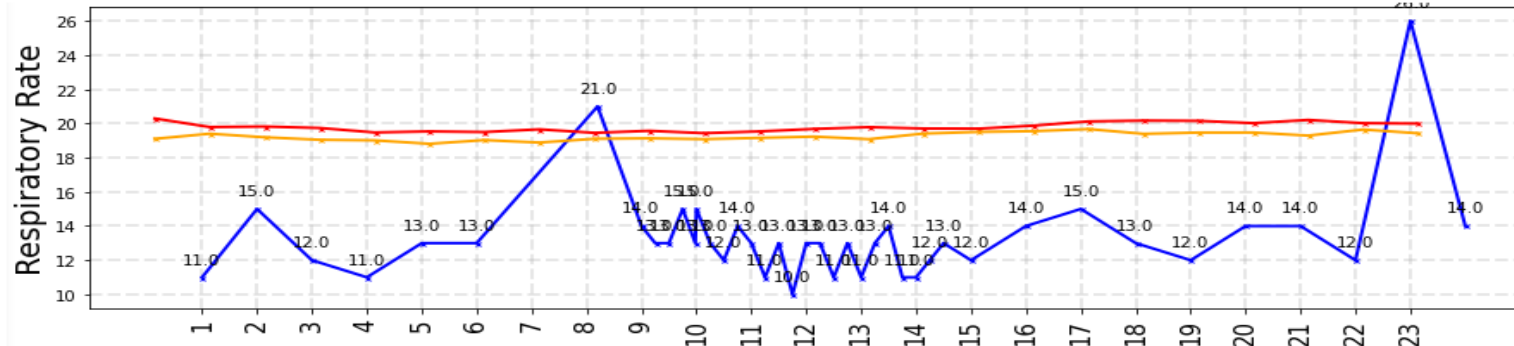
# Another Example : Patient 83607

## Diagnoses

### PATIENT INFORMATION

Gender Female  
Age 49 (hosp. entry)  
Diabet. YES  
Death AFTER ICU, 92 days after ICU discharge

40391	Hypertensive chronic kidney disease, unspecified, with chronic kidney disease stage V or end stage renal disease
7907	Bacteremia
5531	Umbilical hernia without mention of obstruction or gangrene
25042	Diabetes with renal manifestations, type II or unspecified type, uncontrolled
V4511	Renal dialysis status
0417	Pseudomonas infection in conditions classified elsewhere and of unspecified site



— Target Patient  
— Patients in 5 years range  
— Population

# Example Patient: 83607

## INPUTEVENTS

TIME	ITEM	AMOUNT	AMOUNT UNITS	RATE	RATE UNITS	TABLE
0.0 Hours after ICU entry	Insulin - Regular	2.8	units	6	units/hour	MV
0.5 Hours after ICU entry	Insulin - Regular	7.66929756	units	10.0034316	units/hour	MV
1.3 Hours after ICU entry	Insulin - Regular	12.82340675	units	13.989171	units/hour	MV
2.2 Hours after ICU entry	Insulin - Regular	11.9855142	units	15.9806856	units/hour	MV
2.9 Hours after ICU entry	Insulin - Regular	25.28974176	units	9.9827928	units/hour	MV
5.5 Hours after ICU entry	Insulin - Regular	1.996558416	units	4.99139604	units/hour	MV
5.9 Hours after ICU entry	Insulin - Regular	7.73666349	units	2.99483748	units/hour	MV
11.9 Hours after ICU entry	Insulin - Regular	4	units			MV
12.1 Hours after ICU entry	Insulin - Glargine	7	units			MV

