MIMIC SQL

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Analysis of Pneumonia

Database used - MIMIC III Demo - link
Platform used - Google Cloud Bigquery

1. Total Number of Pneumonia Patients

Counts unique patients diagnosed with Pneumonia exclusively (not related to other problems)

Query 1: Find ICD_9 code for only pneumonia (cause unknown)

```
SELECT icd9_code, long_title

FROM `physionet-data.mimiciii_demo.d_icd_diagnoses`
WHERE LOWER(long_title) LIKE 'p%'  -- Ensures long_title starts with "P"
AND LOWER(long_title) LIKE '%pneumonia%'
AND (LOWER(long_title) LIKE '%unspecified%' AND LOWER(long_title) LIKE '%organism unspecified%');
```

Row	icd9_code	long_title
1	486	Pneumonia, organism unspecified

Query 2: Find Total Number of Pneumonia Patients

```
SELECT COUNT(DISTINCT subject_id) AS total_pneumonia_patients

FROM `physionet-data.mimiciii_demo.diagnoses_icd`
WHERE icd9_code = '486';
```

Row	total_pneumonia_patients
1	23

There are 23 Pneumonia Patients, where signs of Pneumonia exist but no specific pathogen identified for analysing this ICD_9 code.

2. Gender Distribution of Pneumonia Patients

Query: Breaks down pneumonia patients by gender.

```
SELECT gender, COUNT(DISTINCT subject_id) AS patient_count

FROM `physionet-data.mimiciii_demo.patients`
WHERE subject_id IN (
   SELECT DISTINCT subject_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
)
GROUP BY gender;
```

Row	gender	patient_count
1	F	10
2	M	13

Pneumonia appears to slightly affect more males than females in this dataset.

Row	gender	patient_count
1	F	10
2	M	13

3. Age Distribution of Pneumonia Patients (GROUP BY + CASE WHEN)

Query: Categorizes pneumonia patients into different age groups.

```sql
SELECT
   CASE
       WHEN age < 18 THEN '0-17'
       WHEN age BETWEEN 18 AND 40 THEN '18-40'
       WHEN age BETWEEN 41 AND 60 THEN '41-60'
       WHEN age BETWEEN 61 AND 80 THEN '61-80'
       ELSE '80+'
   END AS age_group,
   COUNT(DISTINCT age_calculated.subject_id) AS patient_count
FROM (
   SELECT p.subject_id, (EXTRACT(YEAR FROM admittime) - EXTRACT(YEAR FROM dob)) AS age
   FROM `physionet-data.mimiciii_demo.patients` p
   JOIN `physionet-data.mimiciii_demo.admissions` a ON p.subject_id = a.subject_id
) AS age_calculated
WHERE age_calculated.subject_id IN (
   SELECT DISTINCT subject_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
)
GROUP BY age_group
ORDER BY age_group;
```

Row	age_group	patient_count
1	0-17	1
2	41-60	4
3	61-80	10
4	80+	8

Most patients are over 60 years old, making pneumonia a significant risk factor for older adults.

4. Insurance Distribution for Pneumonia Patients (GROUP BY)

Query: Finds the top 5 insurance providers for pneumonia patients.

```
SELECT insurance, COUNT(DISTINCT hadm_id) AS admission_count

FROM `physionet-data.mimiciii_demo.admissions`
WHERE hadm_id IN (
   SELECT hadm_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
)
GROUP BY insurance
ORDER BY admission_count DESC
LIMIT 5;
```

Row	insurance	admission_count
1	Medicare	20
2	Private	5
3	Medicaid	1

Since Medicare primarily covers older individuals (65+), this aligns with the fact that most pneumonia patients are elderly.

5. Readmission Rate of Pneumonia Patients (Nested Query)

Query: Calculates the percentage of pneumonia patients who were readmitted.

```sql
SELECT
   COUNT(DISTINCT hadm_id) AS readmitted_cases,
   COUNT(DISTINCT subject_id) AS total_patients,
   ROUND(100.0 * COUNT(DISTINCT hadm_id) / COUNT(DISTINCT subject_id), 2) AS readmission_rate
FROM `physionet-data.mimiciii_demo.admissions`
WHERE subject_id IN (
   SELECT subject_id
   FROM `physionet-data.mimiciii_demo.diagnoses_icd`
   WHERE icd9_code = '486'
)
AND subject_id IN (
   SELECT subject_id
   FROM `physionet-data.mimiciii_demo.admissions`
   GROUP BY subject_id
   HAVING COUNT(hadm_id) > 1
);
```

Row	readmitted_cases	total_patients	readmission_rate
1	31	9	344.44

Pneumonia patients frequently return to the hospital, possibly due to complications or incomplete recovery.

6. Average Length of Stay in ICU for Pneumonia Patients

Query: Calculates the average length of ICU stay for pneumonia patients.

```
SELECT ROUND(AVG(los), 2) AS avg_icu_stay_days
FROM `physionet-data.mimiciii_demo.icustays`
WHERE subject_id IN (
   SELECT DISTINCT subject_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
);
```

Row	avg_icu_stay_days
1	3.74

This suggests that pneumonia patients typically spend around 4 days in the ICU before stabilizing or requiring further care.

7. Top 5 Medications Prescribed for Pneumonia Patients

Query: Finds the most commonly prescribed medications for pneumonia treatment.

```
SELECT p.drug, COUNT(DISTINCT p.hadm_id) AS prescription_count
FROM `physionet-data.mimiciii_demo.prescriptions` p
JOIN `physionet-data.mimiciii_demo.diagnoses_icd` d ON p.hadm_id = d.hadm_id
WHERE d.icd9_code = '486'
GROUP BY p.drug
ORDER BY prescription_count DESC
LIMIT 5;
```

Row	drug	prescription_count
1	Sodium Chloride 0.9% Flush	22
2	Iso-Osmotic Dextrose	21
3	Heparin	20
4	Acetaminophen	18
5	D5W	18

Most medications are fluids and supportive care drugs, indicating that pneumonia patients often need hydration, anticoagulation, and fever management.

8. Most Common Lab Tests for Pneumonia Patients

Query: Identifies the top 3 most frequently ordered lab tests for pneumonia patients.

```sql
SELECT l.itemid, d.label, COUNT(*) AS test_count
FROM `physionet-data.mimiciii_demo.labevents` l
JOIN `physionet-data.mimiciii_demo.d_labitems` d ON l.itemid = d.itemid
WHERE l.subject_id IN (
   SELECT DISTINCT subject_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
)
GROUP BY l.itemid, d.label
ORDER BY test_count DESC
LIMIT 3;
```

Row	itemid	label	test_count
1	51221	Hematocrit	750
2	50971	Potassium	710
3	50912	Creatinine	699

Patients are being monitored for Hematocrit, Potassium and Creatinine tests while receiving fluids

9. Patients with Low Oxygen Saturation (SpO2 < 90%)

Query: Identifies pneumonia patients who had dangerously low SpO2 levels (<90%).

```
SELECT COUNT(DISTINCT subject_id) AS low_spo2_patients
FROM `physionet-data.mimiciii_demo.chartevents`
WHERE itemid = 220277  -- Oxygen Saturation (SpO2)
AND valuenum < 90
AND subject_id IN (
   SELECT DISTINCT subject_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
);
```

Row	low_spo2_patients
1	10

There are 10 patients with very low Sp02 level, highlighting the need for respiratory support

10. Mortality Rate of Pneumonia Patients in Hospitals

Query: Calculates the mortality rate among pneumonia patients.

```sql
WITH total_pn AS (
   SELECT COUNT(DISTINCT subject_id) AS total_pneumonia_patients
   FROM `physionet-data.mimiciii_demo.diagnoses_icd`
   WHERE icd9_code = '486'
)
SELECT
   COUNT(DISTINCT p.subject_id) AS deceased_patients,
   (SELECT total_pneumonia_patients FROM total_pn) AS total_pneumonia_patients,
   ROUND(100.0 * COUNT(DISTINCT p.subject_id) / (SELECT total_pneumonia_patients FROM total_pn), 2) AS mortality_rate
FROM `physionet-data.mimiciii_demo.patients` p
WHERE p.DOD_HOSP IS NOT NULL
AND p.subject_id IN (
   SELECT DISTINCT subject_id FROM `physionet-data.mimiciii_demo.diagnoses_icd` WHERE icd9_code = '486'
);
```

Row	deceased_patients	total_pneumonia_patients	mortality_rate
1	16	23	69.57

High mortality rate of 70% suggest than since most patients are elderly, Pneumonia can be fatal at older age.

Summary

Pneumonia in the ICU is a severe, life-threatening condition, especially for older adults. The high mortality rate (70%) and extreme readmission rates (344%) indicate that many patients struggle with long-term complications. The use of fluids, oxygen support, and frequent lab monitoring suggests an aggressive approach to stabilizing critically ill pneumonia patients.

Proper hydration, respiratory support, and close monitoring of kidney function are crucial for managing pneumonia patients in the ICU.