Proof of Concept with LLM

To demonstrate the feasibility of using an LLM for a specific application or task, the goal is to validate whether the LLM can achieve the intended functionality before investing significant resources into full-scale development. I decided to directly ask Grok, ChatGPT, and Gemini to provide a short SBAR based on the given nurse note.

NOTE: This was generated using the **web console** of the models mentioned here.

Question:

You are a nurse and need to generate an SBAR report before the end of your shift. You will be provided with the following nurse notes.

> **Sample Nursing Note**
>
> Patient Information:
> Name: John Doe
> MRN: JD-001
> DOB: January 20, 1984
> Age: 40
> Gender: Female
> Room Number: 0022
> Date: February 12, 2025
> Time: 14:00
>
> Admission Date: February 01, 2025
> Primary Diagnosis: Not Applicable
> Secondary Diagnoses: Not Applicable
>
> Vital Signs:
> Temperature: 37.9°C
> Pulse: 120 bpm
> Respiratory Rate: 20 breaths/min
> Blood Pressure: 130/100 mmHg
> Oxygen Saturation: 80%
> Pain Scale: 5
>
> General Appearance:
> Alert & Oriented: Not Applicable
> General Mood/Affect: anxious
>
> Neurological:
> GCS: Not Applicable
> Pupils: Not Applicable
> Motor Function: Not Applicable

Cardiovascular:
Heart Sounds: S1
Edema: Not Applicable
Peripheral Pulses: Not Applicable

Respiratory:
Breath Sounds: Crackles
Cough: Present, Non-productive
Use of Accessory Muscles: No

Gastrointestinal:
Abdomen: Tender
Bowel Sounds: Increased
Last Bowel Movement: Yesterday
Diet: Clear Liquid

Genitourinary:
Urine Output: Yellow
Catheter: In place

Skin:
Condition: Dry
Color: Pale
Wounds: Not Applicable

Musculoskeletal:
Mobility: Assisted
Range of Motion: Limited

Psychosocial:
Family Support: Absent
Patient Education: Understanding
Coping Mechanisms: Needs Support

Medications:
Current Medications: Route
New Orders: Not Applicable

Nursing Interventions:
Completed: [List actions taken, e.g., medication administration, wound care]
Planned: [List planned interventions, e.g., turning schedule, monitoring]

Patient Response:
To Interventions: Positive

Discharge Planning:
Progress Toward Goals: Deteriorating
Potential Barriers: Not Applicable

Education Provided: Not Applicable

Signature:
Nurse: Jaqueline de Dios
License Number N-1009
Date/Time: February 12, 2025

Answer:

GROK

SBAR Report

S - Situation

- **Patient:** John Doe, 40-year-old female, Room 0022
- **Current Issue:** Patient is exhibiting elevated vital signs and respiratory distress. As of 14:00 on February 12, 2025:
    - Temperature: 37.9°C
    - Pulse: 120 bpm
    - Respiratory Rate: 20 breaths/min
    - Blood Pressure: 130/100 mmHg
    - Oxygen Saturation: 80%
    - Pain Scale: 5/10
- **General Status:** Patient appears anxious, with crackles in breath sounds and a non-productive cough. Oxygen saturation is critically low at 80%.

B - Background

- **Admission Date:** February 01, 2025
- **Primary Diagnosis:** Not specified
- **Secondary Diagnoses:** Not specified
- **Relevant History:** Patient has been in care for 11 days. Notable findings include a tender abdomen with increased bowel sounds, dry and pale skin, limited range of motion, and a catheter in place with yellow urine output. Last bowel movement was yesterday. Diet restricted to clear liquids. Family support is absent, and the patient needs coping support.

A - Assessment

- **Vital Signs Concern:** Tachycardia (pulse 120 bpm), hypertension (130/100 mmHg), and hypoxia (O2 sat 80%) suggest potential respiratory or cardiovascular compromise.
- **Respiratory:** Crackles and non-productive cough indicate possible fluid overload or infection (e.g., pneumonia).
- **Gastrointestinal:** Tender abdomen with increased bowel sounds may suggest irritation or early obstruction.

- **General Condition:** Patient's anxiety, pale/dry skin, and deteriorating progress toward goals are concerning. Pain at 5/10 requires management.
- **Psychosocial:** Lack of family support and need for coping mechanisms may impact recovery.

R - Recommendation

1. **Immediate Actions:**
    - Notify the physician regarding low oxygen saturation (80%) and request an urgent respiratory assessment (e.g., chest X-ray, oxygen therapy).
    - Administer pain relief as per standing orders for pain level 5/10.
    - Monitor vital signs every 15-30 minutes due to instability.
2. **Ongoing Care:**
    - Continue clear liquid diet and monitor abdominal tenderness/bowel sounds.
    - Maintain catheter care and track urine output.
    - Reposition patients to assist mobility and prevent pressure injuries (limited range of motion noted).
3. **Support:**
    - Provide emotional support or request a social work consult for coping mechanisms, given absent family support.
4. **Handoff Notes:**
    - Watch for worsening respiratory status (crackles, hypoxia) and report any changes immediately.
    - Follow up on new physician orders post-assessment.

Signature:
Nurse: Jaqueline de Dios, License Number N-1009
Date/Time: February 12, 2025, 14:00

CHATGPT

SBAR Report

Situation:
Patient John Doe (MRN: JD-001), a 40-year-old female, is currently in Room 0022. She was admitted on February 1, 2025. At 14:00, the patient was noted to be anxious, with crackles in breath sounds, a non-productive cough, pale and dry skin, and an oxygen saturation of 80%. Vital signs include temperature 37.9°C, pulse 120 bpm, respiratory rate 20 breaths/min, and BP 130/100 mmHg. She reports a pain level of 5.

Background:
The patient has no primary or secondary diagnosis noted. She is currently on a clear liquid diet. Her mobility is assisted, and ROM is limited. Family support is absent, and she requires

psychosocial support. Urine output is yellow, and a catheter is in place. Last bowel movement was yesterday, with increased bowel sounds and abdominal tenderness.

Assessment:

- Neurological: No notable findings.
- Cardiovascular: **S1 heart sound, no edema noted.**
- Respiratory: Crackles in breath sounds, non-productive cough, oxygen saturation at 80%. No use of accessory muscles.
- Gastrointestinal: Tender abdomen, increased bowel sounds.
- Genitourinary: Catheter in place, yellow urine.
- Skin: Dry, pale, no wounds noted.
- Musculoskeletal: Assisted mobility, limited ROM.
- Psychosocial: Anxious, lacks family support, requires coping support.
- Discharge Planning: Deteriorating progress.

Recommendation:

- Immediate oxygen therapy or escalation of respiratory support due to low O2 saturation (80%).
- Further assessment of cardiovascular and respiratory function due to tachycardia and abnormal breath sounds.
- Pain management evaluation.
- Monitoring of bowel function and abdominal tenderness.
- Psychosocial support to address anxiety and lack of family support.
- Continued close monitoring of vitals, mobility assistance, and planned interventions.

Reported by:
Nurse Jaqueline de Dios (License Number: N-1009)
Date/Time: February 12, 2025

GEMINI

SBAR Report

- **Situation:**
    - This is John Doe, MRN JD-001, a 40-year-old female admitted on February 1st, 2025, in room 0022.
    - Current time is 14:00 on February 12th, 2025.
    - The patient presents with increased respiratory rate (20 breaths/min), tachycardia (120 bpm), elevated blood pressure (130/100 mmHg), and decreased oxygen saturation (80%).
    - She has a temperature of 37.9 C.
    - She is reporting pain of 5.
    - Her general mood is anxious.
- **Background:**

    - The patient has crackles in her breath sounds, a non-productive cough, and is pale.
    - She has an abdominal tenderness with increased bowel sounds.
    - She is on a clear liquid diet.
    - She has a catheter in place, with yellow urine output.
    - Mobility is assisted, with limited range of motion.
    - Patient is in need of coping support, and has absent family support.
    - Patient progress is deteriorating.
- **Assessment:**
    - The patient's respiratory status is compromised, as evidenced by low oxygen saturation and crackles.
    - The elevated pulse and blood pressure, along with the patient's anxiety and pain, indicates a need for immediate intervention.
    - **The patient has a fever.**
    - The abdominal tenderness requires further investigation.
    - The patient is in need of psychosocial support.
- **Recommendation:**
    - Immediate oxygen therapy is required to address the low oxygen saturation.
    - A physician evaluation is needed to address the tachycardia, hypertension, fever, and respiratory distress.
    - Pain management should be initiated.
    - Further assessment of the abdominal tenderness is necessary.
    - Psychosocial support should be provided.
    - Frequent monitoring of vital signs and respiratory status is essential.
    - Lab work and possible chest x-ray should be considered.
    - Reassessment of the patients pain level is required.
    - A social worker should be contacted to assist with the patient's lack of family support.
    - Continued monitoring of the patient's urine output.

Nurse: Jaqueline de Dios, License Number N-1009.

LLM Validation

	GROK	CHATGPT	GEMINI
Clarity & Readability	detail and readability	organized but **clinical**	concise but lacks depth
Assessment and Recommendations	Provides recommendation e.g. specifying monitoring every 15-30 minutes	“S1 heart sound, no edema noted” and “no use of accessory muscles,” This was not initially reported in the nurse's notes.	The patient was mistakenly tagged as having a fever.

		General, covers all points	
Background Section Analysis	Captures the patient's historical data	Captures the patient's historical data	Captures the patient's historical data
Accuracy Issues	None noted	Adds unstated details (heart sounds, no edema)	Incorrectly identifies 37.9°C as fever

NOTE: This was generated using the **API** of the models mentioned here.

Data:

Patient Number 1


```
{
  "first_name": "John",
  "last_name": "Muller",
  "birth_date": "1984-03-11",
  "medical_record_number": "P-12345",
  "room_number": "001",
  "admission_date": "2025-03-11T07:17:51.584Z"
}
{
  "time_stamp": "2025-03-11T07:17:38.307Z",
  "blood_pressure_systolic": 150,
  "blood_pressure_diastolic": 100,
  "heart_rate": 72,
  "respiratory_rate": 18,
  "oxygen_saturation": 97,
  "temperature": 36,
  "source": ""manual entry",
  "patient_id": 1
```

}

{

"time_stamp": "2025-03-11T07:23:09.833Z",

"data_type": "string",

"data_value": {"Total cholesterol": "250mg/dl", "Fasting Blood Glucose": "110mg/dl"},

"source": "lab_result",

"patient_id": 1

}

{

"time_stamp": "2025-03-11T07:28:47.311Z",

"note_text": "Patient admitted due to dizziness and right body weakness. Upon checking, patient is coherent, has slurring of speech and agitated",

"category": "condition change",

"patient_id": 1,

"nurse_id": 1

}

SBAR responses from each of the models

CHATGPT

{

"sbar_report": {

"patient": {

"name": "John Muller",

"mrn": "P-12345",

"age": 41,

"gender": "Male",

"room_number": 1,

"admission_date": "2025-03-11T08:17:51"

},

"situation": {

```
      "feedback": [
        "Patient admitted due to dizziness and right body weakness.",
        "Patient is coherent but has slurring of speech and is agitated."
      ]
    },
    "background": [
      "Primary diagnosis: Dizziness and right body weakness.",
      "Key medical history: No known allergies.",
      "Recent treatments: Patient has been monitored for neurological symptoms."
    ],
    "assessment": [
      "Vital signs: BP 150/100, HR 72, RR 18, Temp 36.0, O2 Sat 97%.",
      "Total cholesterol: 250 mg/dl, Fasting Blood Glucose: 110 mg/dl.",
      "Patient's condition is stable but requires close monitoring due to neurological symptoms."
    ],
    "recommendation": [
      "Monitor vital signs every 4 hours.",
      "Assess neurological status frequently.",
      "Consider consulting neurology for further evaluation."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```

GEMINI


```
{
  "sbar_report": {
    "patient": {
      "name": "John Muller",
      "mrn": "P-12345",
      "age": 41,
      "gender": "Male",
      "room_number": 1,
      "admission_date": "2025-03-11"
    },
    "situation": {
      "feedback": [
        "Patient admitted due to dizziness and right body weakness.",
        "Patient is coherent but has slurring of speech and is agitated.",
        "Vital signs: BP 150/100, HR 72, RR 18, SpO2 97%, Temp 36.0°C."
      ]
    },
    "background": [
      "Admitted for evaluation of dizziness and right body weakness.",
      "Lab results show elevated total cholesterol (250mg/dl) and fasting blood glucose (110mg/dl).",
      "Patient is coherent, but has slurring of speech and is agitated."
    ],
    "assessment": [
      "Patient's condition is concerning due to new onset neurological symptoms (dizziness, right body weakness, slurred speech).",
      "Agitation may be related to underlying condition or anxiety.",
      "Elevated cholesterol and blood glucose levels noted."
```

```
    ],
    "recommendation": [
      "STAT neurological consult is recommended.",
      "Monitor vital signs every 2 hours.",
      "Assess neurological status and document changes.",
      "Keep the patient safe to avoid falls."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```


GROQ (`llama`)


```
{
  "sbar_report": {
    "patient": {
      "name": "John Muller",
      "mrn": "P-12345",
      "age": 41,
      "gender": "Male",
      "room_number": 1,
      "admission_date": "2025-03-11 08:17:51"
    },
    "situation": {
      "feedback": [
        "Patient admitted due to dizziness and right body weakness",
        "Patient is coherent, has slurring of speech and agitated",
```

```
      "Vital signs: blood pressure 150/100, heart rate 72, oxygen saturation 97",
      "Current temperature: 36.0"
    ]
  },
  "background": [
    "Primary diagnosis: unknown",
    "Lab results: Total cholesterol 250mg/dl, Fasting Blood Glucose 110mg/dl",
    "Medical history: unknown",
    "Recent treatments or interventions: unknown"
  ],
  "assessment": [
    "Patient's symptoms are being monitored",
    "Vital signs are being closely watched",
    "Patient's condition is being assessed for potential stroke or other neurological issues",
    "Further testing may be needed to determine the cause of the patient's symptoms"
  ],
  "recommendation": [
    "Continue to monitor the patient's vital signs and neurological status",
    "Administer medications as prescribed",
    "Prepare for potential transfer to a higher level of care if the patient's condition worsens",
    "Notify the physician of any changes in the patient's condition"
  ],
  "reported_by": {
    "nurse": "Jaqueline de Dios",
    "license_number": "L-12345"
  }
 }
}
```

XAI


```
{
  "sbar_report": {
    "patient": {
      "name": "John Muller",
      "mrn": "P-12345",
      "age": 41,
      "gender": "Not specified",
      "room_number": 1,
      "admission_date": "2025-03-11"
    },
    "situation": {
      "feedback": [
        "Current vital signs: BP 150/100 mmHg, HR 72 bpm, RR 18 breaths/min, Temp 36.0°C, SpO2 97%",
        "Patient is experiencing dizziness, right body weakness, slurring of speech, and agitation"
      ]
    },
    "background": [
      "Admitted due to dizziness and right body weakness",
      "Lab results: Total cholesterol 250mg/dl, Fasting Blood Glucose 110mg/dl",
      "No recent treatments or interventions mentioned"
    ],
    "assessment": [
      "Patient is coherent but has slurring of speech and agitation, indicating possible neurological involvement",
      "Vital signs are within normal limits, but the neurological symptoms are concerning",
      "Uncertain if the symptoms are related to high cholesterol or blood glucose levels"
    ],
    "recommendation": [
      "Monitor vital signs every 4 hours",
      "Alert: Patient at risk for neurological complications",
      "Consider ordering a neurological consult and imaging studies",
      "Administer antihypertensive medication if BP rises above 160/100 mmHg"
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```


LLM API Comparison

	GROK	CHATGPT	GEMINI	GROQ(llama)
Clarity & Readability	Clear, but exploring more possible diagnoses	Clear, provided short, direct evaluation	Clear, **but it already provides a definite**	Same ChatGPT, but it responded with **'Unknown'**.

			conclusion without sufficient laboratory and data evidence.	
Recommendations	Provided a good assessment and recommendation. **It also included requests for further studies and second opinions.**	Provided good assessment and recommendation	Provided good assessment and recommendation	Provided good assessment and recommendation
Background Section Analysis	The process and technical evaluation of the system are correct.	The process and technical evaluation of the system are correct."	The process and technical evaluation of the system are correct."	The process and technical evaluation of the system are correct."
Accuracy Issues	Accurate	Accurate	Accurate	Accurate

Patient Number 2


```
{
  "first_name": "John",
  "last_name": "Doe",
  "sex": "Male",
  "birth_date": "1986-06-05",
  "medical_record_number": "P-285175",
  "room_number": "002",
  "admission_date": "2025-03-12T09:51:33.850Z"
}

{
  "time_stamp": "2025-03-12T09:54:11.460Z",
  "blood_pressure_systolic": 110,
  "blood_pressure_diastolic": 80,
  "heart_rate": 71,
  "respiratory_rate": 20,
  "oxygen_saturation": 99,
  "temperature": 36.5,
  "source": "manual entry",
  "patient_id": 4
}
```

{
  "time_stamp": "2025-03-12T09:56:09.360Z",
  "data_type": "lab_result",
  "data_value": {"Fasting Blood Glucose": "80mg/dl", "Cholesterol": "111.3mg/dl", "Triglycerides": "98.4mg/dl", "HDL": "29.9mg/dl", "LDL": "61.72mg/dl", "VLDL": "19.68mg/dl", "Creatinine": "0.77mg/dl", "EGFR: CKD-EPI": "118.00mL/min/l", "ALT(SGPT)": "59.0U/L", "Uric Acid": "9.2mg/dl"},
  "source": "nurse entry",
  "patient_id": 4
}

{
  "time_stamp": "2025-03-12T09:56:09.360Z",
  "data_type": "lab_result",
  "data_value": {"Urinalysis Macroscopic Color": "Dark Staw", "Urinalysis Macroscopic Transparency": "Slightly Turbid", "Urinalysis Macroscopic pH": "5.0", "Urinalysis Macroscopic Specific Gravity": "1.030", "Urinalysis Chemical Sugar": "Negative", "Urinalysis Chemical Protein": "Trace", "Urinalysis Microscopic PUS Cells": "60-65", "Urinalysis Microscopic Red Blood Cells": "6-8", "Urinalysis Microscopic Epithelial Cells": "Occasional", "Urinalysis Microscopic Bacteria": "Moderate", "Urinalysis Microscopic Mucus Threads": "Moderate", "Urinalysis Microscopic Amorphous Urates": "Moderate", "Urinalysis Microscopic Hyaline Cast": "0-2", "Urinalysis Microscopic Renal Cells": "Few"},
  "source": "nurse entry",
  "patient_id": 4
}

{
  "time_stamp": "2025-03-12T09:56:09.360Z",
  "data_type": "lab_result",
  "data_value": {"Hematology Complete Blood Count Hemoglobin": "146", "Hematology Complete Blood Count Hematocrit": "0.46", "Hematology Complete Blood Count RBC": "5.45", "Hematology Complete Blood Count WBC": "5.6", "Hematology Complete Blood Count Platelet": "246", "Hematology Red Cell Indices MCV": "83.9", "Hematology Red Cell Indices MCH": "26.7", "Hematology Red Cell Indices MCHC": "31.8", "Hematology Differential Count Neutrophils": "52", "Hematology Differential Count Lymphocytes": "28", "Hematology Differential Count Monocytes": "17", "Hematology Differential Count Eosinophils": "3", "Hematology Differential Count Basophils": "0", "Total Diff Count": "100"},
  "source": "nurse entry",
  "patient_id": 4
}

{
  "time_stamp": "2025-03-12T09:56:09.360Z",
  "data_type": "x_ray",
  "data_value": {"Chest PA": "Lung fields are clear. Heart and great vessels are within normal size", "Remark": "Unremarkable Chest Xray"},
  "source": "nurse entry",
  "patient_id": 4
}

SBAR responses from each of the models

CHATGPT


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
      "gender": "Male",
      "room_number": 2,
      "admission_date": "2025-03-12T10:51:33"
    },
    "situation": {
      "feedback": [
        "Patient is stable with no acute issues at this time."
      ]
    },
    "background": [
      "Primary diagnosis: Unspecified condition leading to admission.",
      "No known allergies.",
      "Recent treatments include routine lab tests and chest X-ray."
    ],
    "assessment": [
      "Vital signs are stable: BP 110/80, HR 71, RR 20, Temp 36.5°C, O2 Sat 99%.",
      "Chest X-ray shows clear lung fields and normal heart size.",
      "Lab results indicate normal hematology and slightly elevated urinalysis PUS cells."
    ],
    "recommendation": [
```

```
      "Continue to monitor vital signs every 4 hours.",
      "Ensure hydration and monitor urine output due to urinalysis findings.",
      "Follow up on lab results and consider further evaluation if symptoms develop."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```


GEMINI


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
      "gender": "Male",
      "room_number": 2,
      "admission_date": "2025-03-12"
    },
    "situation": {
      "feedback": [
        "Patient admitted on March 12, 2025",
        "Current vital signs: Blood pressure 110/80, heart rate 71, respiratory rate 20, temperature 36.5°C, oxygen saturation 99%"
      ]
    },
```

```
    "background": [
      "Patient admitted for further evaluation.",
      "Key medical history: No significant medical history provided.",
      "Recent treatments/interventions: Initial assessment and vital signs taken. Lab results and X-ray obtained."
    ],
    "assessment": [
      "Vital signs are stable.",
      "Lab results show slightly turbid urine with elevated pus cells and bacteria, uric acid level is slightly elevated, ALT(SGPT) is also slightly elevated.  X-ray unremarkable."
    ],
    "recommendation": [
      "Continue to monitor vital signs every 4 hours.",
      "Follow up on urinalysis and liver function. Consider repeating labs if clinically indicated.",
      "Ensure patient comfort and address any concerns."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```


GROQ


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
```

```
    "gender": "Male",
    "room_number": 2,
    "admission_date": "2025-03-12 10:51:33"
  },
  "situation": {
    "feedback": [
      "Blood pressure is 110/80 mmHg",
      "Heart rate is 71 beats per minute",
      "Respiratory rate is 20 breaths per minute",
      "Temperature is 36.5 degrees Celsius",
      "Oxygen saturation is 99%"
    ]
  },
  "background": [
    "Primary diagnosis: Not specified",
    "Reason for admission: Not specified",
    "Key medical history: Not specified",
    "Recent treatments or interventions: Lab results show normal hemoglobin, hematocrit, RBC, WBC, and platelet counts",
    "Recent lab results: Urinalysis shows slightly turbid urine with moderate bacteria and mucus threads",
    "Recent lab results: Fasting blood glucose is 80mg/dl, cholesterol is 111.3mg/dl, triglycerides are 98.4mg/dl"
  ],
  "assessment": [
    "Vital signs are stable",
    "Lab results show no significant abnormalities",
    "Patient is currently not experiencing any urgent issues",
    "Patient's condition is being closely monitored"
```

```
    ],
    "recommendation": [
      "Continue to monitor vital signs every 4 hours",
      "Follow up on lab results and report any abnormalities",
      "Administer medications as prescribed",
      "Assess patient's condition regularly and report any changes"
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```


XAI


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
      "gender": "Male",
      "room_number": 2,
      "admission_date": "2025-03-12"
    },
    "situation": {
      "feedback": [
        "Current vital signs: BP 110/80 mmHg, HR 71 bpm, RR 20 breaths/min, Temp 36.5°C, SpO2 99%."
```

```
      ]
    },
    "background": [
      "Reason for admission: Not specified in the provided data.",
      "Key medical history: Not provided in the data.",
      "Recent treatments/interventions: Chest X-ray performed showing clear lung fields and normal heart size. Recent lab results include normal hematology, urinalysis indicating trace protein and signs of infection, and normal metabolic panel."
    ],
    "assessment": [
      "Patient's vital signs are within normal limits.",
      "Chest X-ray unremarkable, suggesting no acute respiratory or cardiac issues.",
      "Lab results show normal blood counts, but urinalysis indicates a possible urinary tract infection due to bacteria and increased pus cells.",
      "Metabolic panel within normal limits, indicating good control of metabolic functions."
    ],
    "recommendation": [
      "Continue monitoring vital signs every 4 hours.",
      "Follow up on the urinalysis results with a possible urine culture to confirm UTI and start appropriate treatment if necessary.",
      "No immediate changes to the current care plan based on current data."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```

Regeneration: New and Updated Nurse Note


```
{
  "time_stamp": "2025-03-12T10:45:09.229Z",
  "note_text": "Correction Patient Temperature: Patient admitted because of High Fever 40 degrees
celsius",
  "category": "condition change",
  "patient_id": 4,
  "nurse_id": 1
}
```


CHATGPT


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
      "gender": "Male",
      "room_number": 2,
      "admission_date": "2025-03-12T10:51:33"
    },
    "situation": {
      "feedback": [
        "Patient is stable with no acute issues at this time.",
        "Correction Patient Temperature: Patient admitted because of High Fever 40 degrees Celsius"
      ]
    },
    "background": [
      "Primary diagnosis: Unspecified condition leading to admission.",
      "No known allergies.",
      "Recent treatments include routine lab tests and chest X-ray."
    ],
    "assessment": [
      "Vital signs are stable: BP 110/80, HR 71, RR 20, Temp 36.5°C, O2 Sat 99%.",
      "Chest X-ray shows clear lung fields and normal heart size.",
      "Lab results indicate normal hematology and slightly elevated urinalysis PUS cells."
    ],
    "recommendation": [
      "Continue to monitor vital signs every 4 hours.",
      "Ensure hydration and monitor urine output due to urinalysis findings.",
      "Follow up on lab results and consider further evaluation if symptoms develop."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```

GEMINI


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
      "gender": "Male",
      "room_number": 2,
      "admission_date": "2025-03-12"
    },
    "situation": {
      "feedback": [
        "Patient admitted on March 12, 2025",
        "Current vital signs: Blood pressure 110/80, heart rate 71, respiratory rate 20, temperature 36.5\n \n\n    \n\n    \n\n    \n\n    \n\n    \n\n    \n\n    \n    C, oxygen saturation 99%",
        "Patient admitted because of high fever 40 degrees Celsius"
      ]
    },
    "background": [
      "Patient admitted for further evaluation.",
      "Key medical history: No significant medical history provided.",
      "Recent treatments/interventions: Initial assessment and vital signs taken. Lab results and X-ray obtained."
    ],
    "assessment": [
      "Vital signs are stable.",
      "Lab results show slightly turbid urine with elevated pus cells and bacteria, uric acid level is slightly elevated, ALT(SGPT) is also slightly elevated.  X-ray unremarkable."
    ],
    "recommendation": [
      "Continue to monitor vital signs every 4 hours.",
      "Follow up on urinalysis and liver function. Consider repeating labs if clinically indicated.",
      "Ensure patient comfort and address any concerns."
    ],
    "reported_by": {
      "nurse": "Jaqueline de Dios",
      "license_number": "L-12345"
    }
  }
}
```


GROQ


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
      "gender": "Male",
```

```
    "room_number": 2,
    "admission_date": "2025-03-12 10:51:33"
   },
   "situation": {
    "feedback": [
     "Blood pressure is 110/80 mmHg",
     "Heart rate is 71 beats per minute",
     "Respiratory rate is 20 breaths per minute",
     "Temperature is 36.5 degrees Celsius",
     "Oxygen saturation is 99%",
     "Patient was admitted due to high fever of 40 degrees Celsius"
    ]
   },
   "background": [
    "Primary diagnosis: Not specified",
    "Reason for admission: High fever",
    "Key medical history: Not specified",
    "Recent treatments or interventions: Lab results show normal hemoglobin, hematocrit, RBC,
WBC, and platelet counts",
    "Recent lab results: Urinalysis shows slightly turbid urine with moderate bacteria and mucus
threads",
    "Recent lab results: Fasting blood glucose is 80mg/dl, cholesterol is 111.3mg/dl, triglycerides are
98.4mg/dl"
   ],
   "assessment": [
    "Vital signs are stable",
    "Lab results show no significant abnormalities",
    "Patient's condition is being closely monitored due to high fever at admission",
    "Patient's temperature has been corrected to 36.5 degrees Celsius"
   ],
   "recommendation": [
    "Continue to monitor vital signs every 4 hours",
    "Follow up on lab results and report any abnormalities",
    "Administer medications as prescribed",
    "Assess patient's condition regularly and report any changes",
    "Monitor patient's temperature closely"
   ],
   "reported_by": {
    "nurse": "Jaqueline de Dios",
    "license_number": "L-12345"
   }
  }
}
```


XAI


```
{
  "sbar_report": {
    "patient": {
      "name": "John Doe",
      "mrn": "P-285175",
      "age": 38,
```

```
    "gender": "Male",
    "room_number": 2,
    "admission_date": "2025-03-12"
   },
   "situation": {
    "feedback": [
     "Current vital signs: BP 110/80 mmHg, HR 71 bpm, RR 20 breaths/min, Temp 36.5°C, SpO2
99%.",
     "Patient admitted due to a high fever of 40°C."
    ]
   },
   "background": [
    "Reason for admission: High fever.",
    "Key medical history: Not provided in the data.",
    "Recent treatments/interventions: Chest X-ray performed showing clear lung fields and normal
heart size. Recent lab results include normal hematology, urinalysis indicating trace protein and signs
of infection, and normal metabolic panel."
   ],
   "assessment": [
    "Patient's vital signs are within normal limits except for the reported admission temperature of
40°C.",
    "Chest X-ray unremarkable, suggesting no acute respiratory or cardiac issues.",
    "Lab results show normal blood counts, but urinalysis indicates a possible urinary tract infection
due to bacteria and increased pus cells.",
    "Metabolic panel within normal limits, indicating good control of metabolic functions.",
    "The high fever upon admission is a concern and needs further investigation."
   ],
   "recommendation": [
    "Continue monitoring vital signs every 4 hours with a focus on temperature.",
    "Follow up on the urinalysis results with a possible urine culture to confirm UTI and start
appropriate treatment if necessary.",
    "Investigate the cause of the high fever upon admission and consider additional diagnostic tests if
necessary.",
    "No immediate changes to current care plan based on current data, but monitor closely for any
changes in condition."
   ],
   "reported_by": {
    "nurse": "Jaqueline de Dios",
    "license_number": "L-12345"
   }
  }
}
```


LLM Comparative Table

Aspect	ChatGPT	Gemini	Groq	XAI
Details	General, stable, **lists correction**	Chronological, detailed vital signs	Itemized vital signs,	Highly specific, investigate **UTI**/fever

			admission reason	

Final Verdict:

Overall Winner: **CHATGPT**

It provided a direct and clear evaluation based on the available data, without seeking a second opinion or requesting additional data for assessment.

For much safer options and an exploratory approach, I recommend using XAI.

Create a comparison table between the LLMs in our case study and reach a recommendation of what to use.

https://www.notion.so/masterschool/Comparison-Table-1889418319f38186af70ce2362cc6cd1

Prompt Research

Prompt research is a field in LLM development, focusing on the design and optimization of prompts to generate desired output.

Template-based prompting

```
- Patient identifiers (name, age, room number). [From Patient Data]
```

The part in brackets, [From Patient Data], is a placeholder that should be replaced with the actual text retrieved from the database—in this case, from Patient Data. This template instructs the model precisely on how to use Few-shot Learning with details such as name, age, and room number.

Instruction-based prompting

Instruction-based prompting is a way to guide large language models (LLMs) by giving them clear, simple instructions in natural language.

```
Your task is to generate an updated structured SBAR report based on the Patient Data,

Vital Signs, Medical Data, the newly updated Nurse Notes, and Nurse Data.
```

In this example it provides a clear, natural language instruction to guide the model's output

Demonstration-based prompting

Demonstration-based prompting is a way to guide large language models (LLMs) by showing them examples of what you want them to do.

```
Recommendation

- Monitoring instructions (e.g., "Check vitals every 4 hours").

- Alerts (e.g., "Patient is a fall risk").

- Follow-up actions (e.g., "Give pain medication at 8 PM").
```

Define prompts in a document

Clear labeling: Each prompt has a unique identifier.

```
system_prompt_generate = """
   You are a nurse preparing a handoff report for the incoming shift.

   Your task is to generate a structured SBAR report based on the Patient
Data,
   Vital Signs, Medical Data, the newly updated Nurse Notes, and Nurse Data.
   Ensure that the report incorporates the most recent information from the
updated Nurse Notes,
   particularly in the Situation, Assessment, and Recommendation sections.

   SBAR stands for Situation, Background, Assessment, and Recommendation.
   It's a standardized communication framework used in healthcare to organize
and deliver critical
   patient information, especially during handoffs. It ensures that essential
details are conveyed clearly,
   reducing the risk of miscommunication and improving patient safety. Here's
a detailed breakdown of each component:

   Situation

   - Patient identifiers (name, age, room number). [From Patient Data]
   - Current vital signs (e.g., blood pressure, heart rate, oxygen levels).
[From Vital Signs and Medical Data]
   - Any urgent issues or changes (e.g., "Patient is experiencing chest
pain"). [From the newly updated Nurse Notes]

   Background

   - Primary diagnosis and reason for admission. [From Medical Data]
   - Key medical history (e.g., chronic conditions, allergies). [From Medical
Data]
```

```
   - Recent treatments or interventions (e.g., medications given, procedures
done). [From Medical Data]

   Assessment

   - Changes or trends in the patient's status (e.g., "Symptoms are
improving").
   - Interpretation of data (e.g., "Vital signs are stable but pain
persists").
   - Any concerns or uncertainties (e.g., "Not sure if nausea is
medication-related").

   Recommendation

   - Monitoring instructions (e.g., "Check vitals every 4 hours").
   - Alerts (e.g., "Patient is a fall risk").
   - Follow-up actions (e.g., "Give pain medication at 8 PM").

   ReportedBy [From Nurse Data]

   - Nurse Name
   - License Number
"""


system_prompt_regeneration_sbar_main = """
   You are a nurse preparing a handoff report for the incoming shift.

   Your task is to generate an updated structured SBAR report based on the
Patient Data,
   Vital Signs, Medical Data, the newly updated Nurse Notes, and Nurse Data.
   Below is the previously generated SBAR report for reference.
   Please update the Situation, Assessment, and Recommendation sections using
   the information from the newly updated Nurse Notes.
   Ensure that the report reflects the most recent patient status and nursing
observations.
   The Background section should remain unchanged unless the newly updated
Nurse Notes
   include new information about the patient's medical history, reason for
admission,
   or recent treatments that are not already captured in the Medical Data.
   The ReportedBy section should remain the same, as it identifies the nurse
providing the handoff.\n
"""

system_prompt_regeneration_sbar_body = """
   \nSituation

   - Patient identifiers (name, age, room number). [From Patient Data]
   - Current vital signs (e.g., blood pressure, heart rate, oxygen levels).
[From Vital Signs and Medical Data]
   - Any urgent issues or changes (e.g., "Patient is experiencing chest
pain"). [From the newly updated Nurse Notes]
```

```
   Background

   - Primary diagnosis and reason for admission. [From Medical Data]
   - Key medical history (e.g., chronic conditions, allergies). [From Medical
Data]
   - Recent treatments or interventions (e.g., medications given, procedures
done). [From Medical Data]

   Assessment

   - Changes or trends in the patient's status (e.g., "Symptoms are
improving").
   - Interpretation of data (e.g., "Vital signs are stable but pain
persists").
   - Any concerns or uncertainties (e.g., "Not sure if nausea is
medication-related").

   Recommendation

   - Monitoring instructions (e.g., "Check vitals every 4 hours").
   - Alerts (e.g., "Patient is a fall risk").
   - Follow-up actions (e.g., "Give pain medication at 8 PM").

   ReportedBy [From Nurse Data]

   - Nurse Name
   - License Number
"""
```

Metadata Inclusion: Details about the input and the expected output.

Input:

```
user_prompt = (
   f"Generate a SBAR using the following:\n Patient Data : {patient},"
   f"\nVital Signs : {vital_signs}, \nMedical Data : {medical_data}, \nNurse
Notes : {nurse_notes} , "
   f"Nurse Data : {nurse} ")

client = openai.OpenAI(api_key=get_open_ai_key())
response = client.beta.chat.completions.parse(
   model=get_open_ai_model(),
   messages=[
       {"role": "system",
        "content": f"{system_prompt}"},
       {"role": "user", "content": f"{user_prompt}"}
   ],
   temperature=0,
   response_format=HandoffReport,
)
```

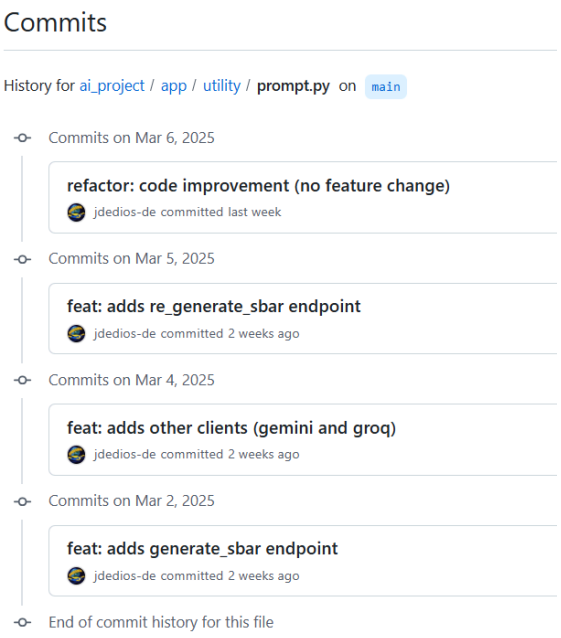
Expected structured output:

```
class HandoffReport(BaseModel):
    situation: Situation
    background: Background
    assessment: Assessment
    recommendation: Recommendation
    reported_by: ReportedBy
```

Standard Format: This is the format presented to API users when generating an SBAR.

```
"sbar_report": {
    "patient": {
        "name": situation.patient_name,
        "mrn": situation.mrn,
        "age": situation.age,
        "gender": situation.gender,
        "room_number": situation.room_number,
        "admission_date": situation.admission_date,
    },
    "situation": {
        "feedback": situation.list_situations_feedback
    },
    "background": background.list_backgrounds,
    "assessment": assessment.list_assessments,
    "recommendation": recommendation.list_recommendations,
    "reported_by": {
        "nurse": reported_by.nurse,
        "license_number": reported_by.license_number
    }
}
```

Version Control: The prompt is added to GitHub for tracking changes.



Define a UML/diagram of the flow of prompts

Nursing Assistant Process Flow

1. Nurse triggers the handoff process and sends a message to the server.
2. The server processes the message, gets the patients data and nurse data to create a prompt for the LLM.
3. The prompt is sent to the LLM, which generates a response.
4. The response is returned to the server and then to the user.

This can be represented in a sequence diagram as follows:

- Nurse → Server: send message
- Server → Server: process message to create prompt
- Server → LLM: send prompt
- LLM → Server: send response
- Server → Nurse: send response

Resources:

https://platform.openai.com/docs/guides/prompt-engineering

Choosing the Gen stack (frameworks, libraries).

Category	Option	Use Case	Key Feature
LLM Provider	OpenAI and XAI	General-purpose tasks	High accuracy, paid API
	GEMI and GROQ	General-purpose tasks	Low Accuracy, free API
Programming Language	Python	AI development	Extensive libraries, community
Interaction Library	OpenAI Python Library	API calls to OpenAI models	Official support, easy integration