



MSA 8770: TEXT ANALYTICS

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FINAL PROJECT

PERSONAL HEALTH COACH APPLICATION

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1. INTRODUCTION & MOTIVATION

Modern patients increasingly rely on the internet to search for health information. However, they frequently experience information overload, difficulty understanding medical terminology, and exposure to unverified or potentially unsafe sources. While Large Language Models (LLMs) can simplify and summarize complex information, a standalone chatbot without grounding in reliable data may hallucinate, produce incomplete answers, or provide unsafe medical suggestions.

To address these limitations, our project proposes the development of a Personal Health Coach App which provides accurate and personalized evidence-informed medical information powered by a multi-agent Retrieval-Augmented Generation (RAG) system.

2. DATASET DESCRIPTION

The primary dataset for the text-retrieval component is the MedlinePlus Health Topics dataset. The dataset was obtained from the compressed XML file 'mplus_topics_compressed_2025-10-01.zip', containing 1,017 English-language health-topic entries. The XML was parsed, cleaned, and converted into a structured CSV file via Python. Each topic includes:

- ID, title, URL, creation date
- Groups/tags (e.g., Diabetes Mellitus, Heart Disease, Symptoms)
- Also-called synonyms
- Full-summary text field

✓ Chunked: 3462 chunks from 1017 topics

id	title	url	groups	chunk_id	text
6308	A1C	https://medlineplus.gov/a1c.html	Diagnostic Tests Diabetes Mellitus	6308_0	A1C is a blood test for type 2 diabetes and prediabetes. It measures your average blood glucose, or blood sugar, level over the past 3 months. Doctors may use the A1C alone or in combination with other diabetes tests to make a diagnosis. They also use the A1C to see how well you are managing your diabetes. This test is different from the blood sugar checks that people with diabetes do every day. Your A1C test result is given in percentages. The higher the percentage, the higher your blood sugar levels have been: A normal A1C level is below 5.7% Prediabetes is between 5.7 to 6.4%. Having prediabetes is a risk factor for getting type 2 diabetes. People with prediabetes may need retests every year

3. IMPLEMENTATION

Embedding and Vector database

The summary text was cleaned, HTML-stripped, and split into 3,462 overlapping chunks using RecursiveCharacterTextSplitter to support dense retrieval. Sentence Transformers (all-MiniLM-L6-v2) generated a 384-dimensional embedding vector for each chunk.

Qdrant cloud was used to store the embeddings in a vector index, for efficient querying and retrieval.

Medical Knowledge Graph (Neo4j)

A Neo4j AuraDB instance stores structured medical knowledge including conditions, symptoms, tests, and relationships. Neo4j is a fully managed graph database which enables deep, contextual understanding of data through knowledge graphs. This is suitable for the health topics database, to enable contextual

medical knowledge for accurate clinical understanding and recommendations. The MedlinePlus XML file is ingested and parsed. Structured Metadata extraction is used to dynamically obtain node labels, properties, and relationship types, and groups. These are used to create constraints and construct the knowledge graph. Below are the steps performed to construct the knowledge graph:

Database information	
Nodes	(54,608)

- XML parsing to extract structured health topic information
- Constraints and Indexed are created to define unique health topics and nodes
- For each health topic, the following information extracted: synonyms, full summary, groups, MeSH (Medical Subject Headings) descriptors, related topics, sites, primary institute, symptoms and tests.
- Nodes are created per health topic with fields: title, URL, language, date created and full summary
- The following connected nodes created for each health topic node, with relationships: symptoms, tests, groups, synonyms, MeSH descriptors, related topics, sites and primary institute.

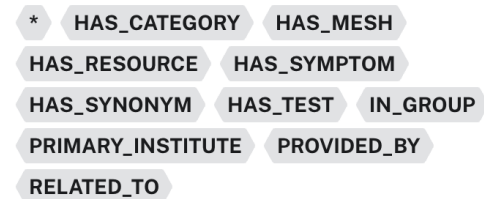
This enables automated Cypher generation via an LLM-powered Cypher construction module. The graph schema is used to generate accurate Cypher queries without hallucinating.

Database information

Nodes (54,608)



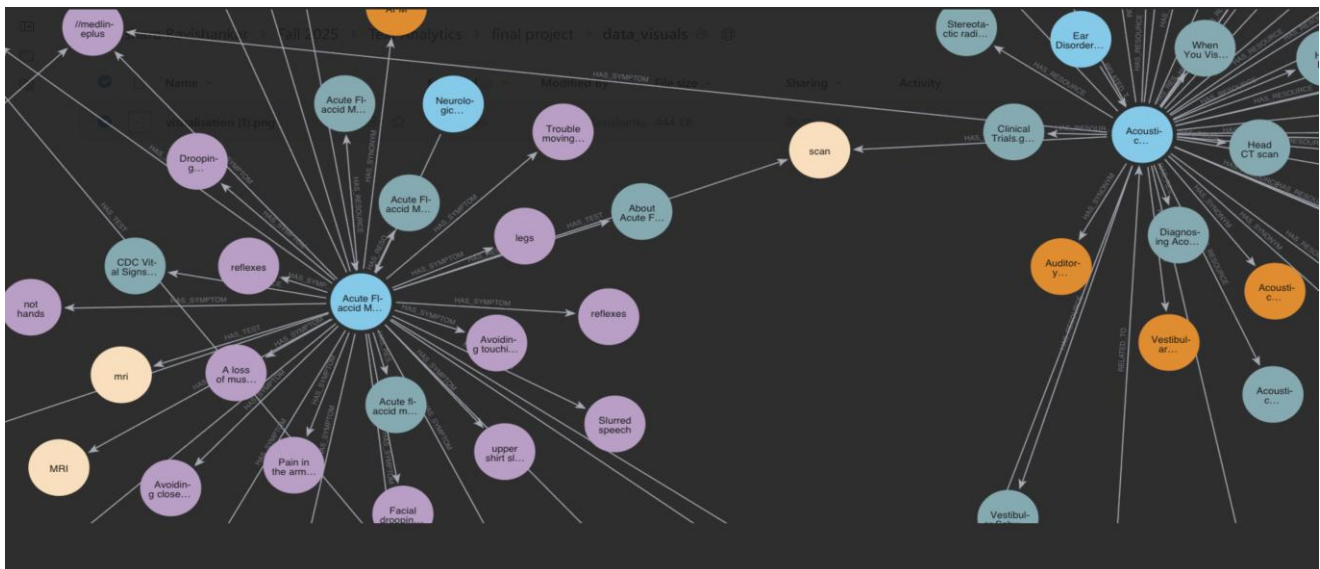
Relationships (141,864)



Property keys

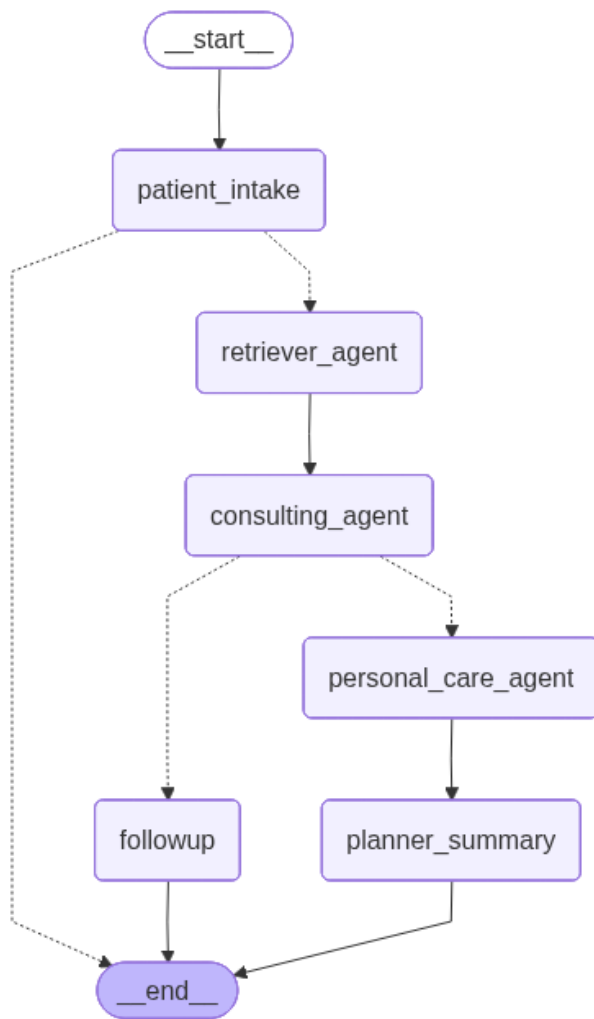


Neo4j Aura database properties



Knowledge Graph snapshot

Multi-Agent System



Multi-agent graph

The project uses LangGraph to orchestrate the below agents:

1. **Retriever Agent**
Retrieves relevant documents from the vector database based on the user's query and symptoms
2. **Consulting Agent**
Collects symptoms, asks follow-ups, builds patient profile, uses short-term memory
3. **Personal Care Agent**
The personal care agent queries knowledge graph to identify possible conditions with treatment information, and generates structured lifestyle guidance with disclaimers. It also uses long-term memory store to retrieve past symptoms and conditions of the given patient to provide relevant recommendations, and save the latest recommendations.

It uses the following tools:

1. `query_medical_knowledge_graph` : Tool for generating Cypher queries taking a dictionary of patient symptoms as input, using OpenAI gpt-4.1-nano LLM model, and retrieving relevant health topic nodes from the Neo4j knowledge graph
2. `get_patient_history`: Tool to retrieve complete patient history including past symptoms and recommendations from Langraph long-term memory store
3. `save_patient_history` : Tool to save recommendations and update patient history in long-term memory store

Memory Management

The application uses both short-term and long-term memory to store patient information, interactions and recommendations and provide relevant personalized health recommendations.

- **Short-term memory:** The application uses Langraph checkpointing for storing the graph's state for each session of execution. It saves checkpoints to the thread created for each session, so that the state can be accessed by different nodes in the graph.
- In our application, the Consulting Agent uses short-term memory to remember patient symptoms, ask follow up questions, and update the patient profile.
- **Long-term memory:** Langraph Memory Store with external persistent SQLite database is used to save detailed Patient Histories, which contain the profile, symptoms

```

{
  "created_at": "2025-12-02T14:34:22.996906",
  "last_updated": "2025-12-02T14:42:30.132589",
  "profile": {
    "age": 43,
    "id": "P-THERES-202512021434",
    "name": "Theresa Lee",
    "sex": "Female",
    "symptoms": [
      {
        "date_recorded": "2025-12-02",
        "description": "Unintentional weight loss of 15 lbs in 2 weeks",
        "duration_days": 30,
        "severity": "unknown"
      },
      {
        "date_recorded": "2025-12-02",
        "description": "Fatigue",
        "duration_days": 30,
        "severity": "unknown"
      },
      {
        "date_recorded": "2025-12-02",
        "description": "Frequent hunger with sugar cravings every 2 hours",
        "duration_days": 30,
        "severity": "unknown"
      }
    ]
  },
  "recommendations": [
    {
      "date": "2025-12-02",
      "possible_conditions": [
        "Unexplained weight loss",
        "Fatigue",
        "Possible metabolic/endocrine disorder (e.g., thyroid, diabetes)",
        "Possible depression or anxiety",
        "Possible infection or inflammatory process"
      ],
      "recommendations": "1. Schedule an appointment with your primary care provider for a comprehensive evaluation.\n2. Request laboratory tests: CBC, comprehensive metabolic panel"
    }
  ],
  "symptoms_at_time": [
    "Unintentional weight loss of 15 lbs in 2 weeks",
    "Fatigue",
    "Frequent hunger with sugar cravings every 2 hours"
  ]
}

```

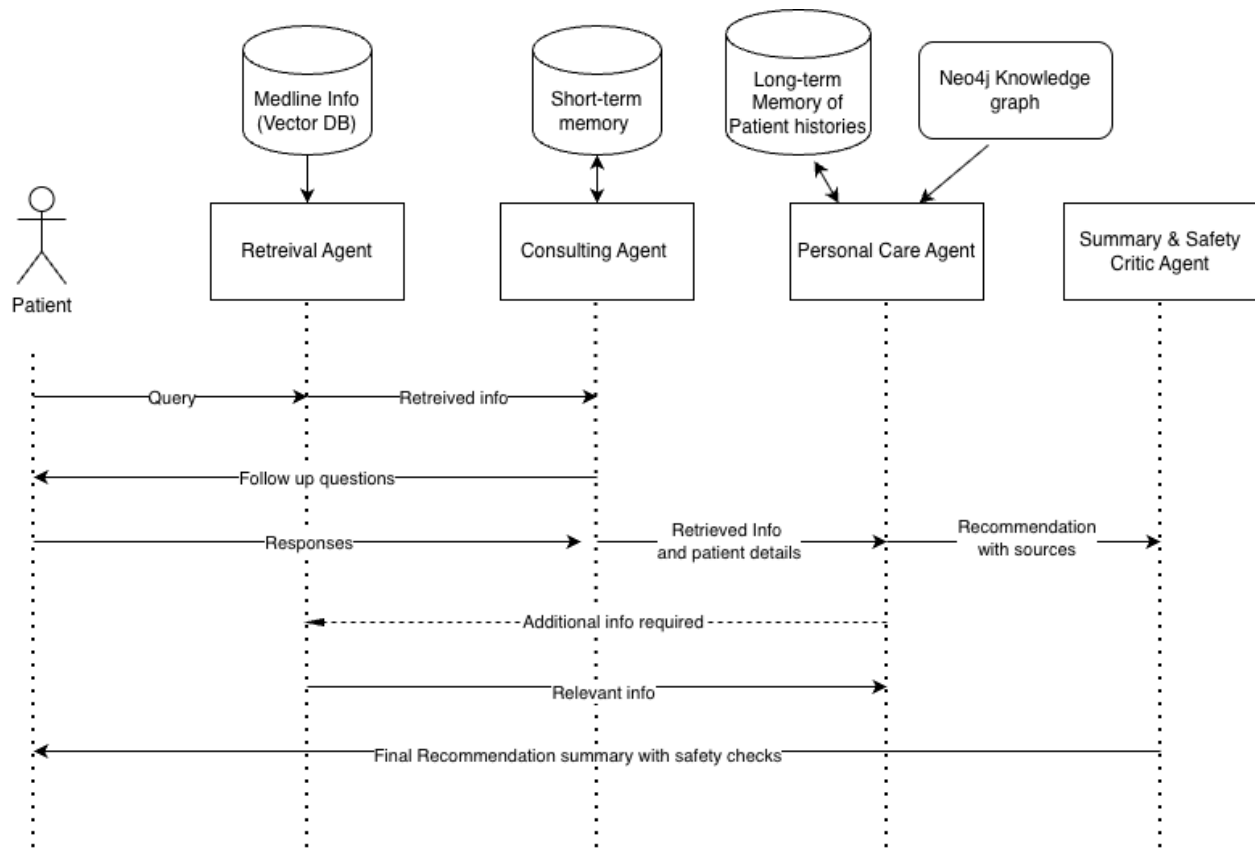
Snapshot of JSON Memory Storage

Agent State for Orchestration

An overall Pipeline State is used to maintain the state of the overall agentic system, which references the individual states of retriever agent, consulting agent and personal care agent. It contains the patient's profile, history from the database, user query and final output, and other variables to manage the flow of the application.

Complete Application Flow

- The patient enters their Patient ID, if they are an existing patient, or create a new profile with name, sex and age
- The patient enters their query with symptoms and details
- The retriever agent retrieves information relevant to user's query from the vector database
- The consulting agent uses the retrieved information to ask relevant follow-up questions to gather more details for analysis. After a maximum of 3 questions, the consulting agent updates the symptoms details in the patient profile, and hands-off to the personal care agent.
- The personal care agent takes the patient's query, retrieved context and updated patient profile from the state. It generates a personalized care plan based on the current symptoms and past history if present.
- The summary node generates a final summary in structured format with disclaimers, which is displayed to the user.



4. RESULTS AND EXAMPLES

The system was tested using queries such as: “I have been losing weight and have sugar cravings.” It successfully retrieved diabetes-related topics, extracted relevant symptoms, matched them against the Neo4j graph (e.g., Diabetes Type 2, Prediabetes), and produced structured recommendations (SEE LIVE DEMO):

- Possible conditions
- Lifestyle modifications
- Tests to discuss with a doctor
- References with URLs

5. EVALUATION

To assess the quality of the Personal Health Coach system, we evaluated four representative patient queries using an automated LLM-based rubric. For each case, the system’s final recommendation summary was scored on:

1. **Medical Correctness:** accuracy of differential diagnosis and recommendations
2. **Safety:** presence of red-flag warnings, risk mitigation, and avoidance of harmful advice
3. **Clarity & Actionability:** how easy the advice is to understand and follow
4. **Overall Quality:** holistic usefulness of the response

Our existing model uses Ollama so we used a separate LLM-judge (OpenAI). It scored each dimension from 1 to 5, with 5 being excellent. Full model-generated recommendations for all four evaluation cases are included in Appendix. The evaluation rubric scores were based on these exact outputs.

Results Summary

Case	Medical	Safety	Clarity	Overall	Evaluation Feedback
1. Acute diarrhea	5	5	5	5	Accurate, high-quality, and well-structured. Excellent safety guidance.
2. Cough + fever (4 days)	3	4	4	3	Over-confident diagnosis of pertussis; antibiotic recommendation may not be appropriate.
3. One-sided headache + light sensitivity	3	5	4	4	Missed most likely diagnosis (migraine). Strong safety guidance but reasoning could be sharper.
4. Chest tightness on exertion	5	5	5	5	Very strong safety emphasis; medically appropriate and well-structured.

Interpretation

Overall, the model:

- performs very strongly on common scenarios (chest pain, diarrhea)
- maintains excellent safety standards, consistently advising when to seek urgent care
- sometimes becomes over-specific without enough evidence (case 2)
- could improve reasoning around common neurological symptoms (case 3)

Conclusion of Evaluation

The evaluation demonstrates that the system is:

- medically cautious and safety-oriented
- able to produce clear, actionable recommendations
- but occasionally over-confident in diagnosis specificity, which can be improved in future iterations by adjusting prompts or adding guardrails.

This balanced result validates both the strengths of the multi-agent design and areas where further refinement is appropriate.

6. FRONT END APPLICATION

We built a full Streamlit front-end on top of our multi-agent health coaching system, which runs entirely through the backend in `health_coach_main.py`. When a user starts a consultation, the app either loads their existing profile from the SQLite memory store or creates a new one, then sends their concern into a LangGraph pipeline that includes the retriever, consulting agent, planner, and personal-care agent. The app mirrors the same logic as our console version: it analyzes the graph state, asks follow-up questions when needed, and shows a final personalized health plan once all essential information is gathered. The result is an interactive, memory-aware health coach with clean UI cards, patient-ID reuse, and a safe, educational care plan generated directly from MedlinePlus content.

The following are some visual screenshots of our streamlit application:

The screenshot displays a web browser window with the title "Personal Health Coach" and the URL "localhost:8501". The interface is divided into a left sidebar and a main content area.

Left Sidebar:

- Patient identification:** Includes a field for "Existing Patient ID (optional)" with the value "P-ERIKAS-202512010302".
- New / updated profile:** Includes fields for "Full name", "Sex" (a dropdown menu), and "Age" (with the example "e.g., 35"). A note below states: "If an existing ID is found, that profile is used. Otherwise a new profile is created with the info above."

Main Content Area:

- Header:** A blue gradient banner with the text "Multi-Agent • MedlinePlus • Memory" and "Personal Health Coach". Below this, a disclaimer states: "This tool uses a multi-agent pipeline (retriever, consulting agent, personal care agent, planner) to turn trusted MedlinePlus content into tailored health education. It is **not** a substitute for professional medical advice. In emergencies, call 911 or your local emergency number."
- Navigation:** Two tabs are visible: "Consulting Conversation" (active) and "Personal Care Plan".
- Section: Describe your health concern**
 - Text input: "What would you like to discuss today?" with the value "I have cough and chest pain".
 - Buttons: "Start / Restart consultation" and "Clear conversation".
 - Status bar: "Loaded existing patient: Erika Steward (ID: P-ERIKAS-202512010302)".
- Section: Follow-up question from consulting agent**
 - Text input: "Why I'm asking this" with the value ">".
 - Question: "Question: Could you tell me how long you've had the cough and chest pain, and how severe they feel?"
 - Text input: "Your answer" with the value "Since a week, the cough is severe".
 - Button: "Send answer".

Initial User Query & the Follow-up Question

PLAN I

The screenshot displays the 'Personal Health Coach' web application. The browser address bar shows 'localhost:8501'. The application has a sidebar on the left for 'Patient identification' and 'New / updated profile'. The main content area is titled 'Personalized health guidance' and features a 'Personalized Plan' section with a table of steps and actions, a 'COMPARISON TO PAST' section, 'NEXT STEPS', and 'REFERENCES'.

Patient identification

Existing Patient ID (optional): P-ERIKAS-202512010302

New / updated profile

Full name:

Sex:

Age: e.g., 35

If an existing ID is found, that profile is used. Otherwise a new profile is created with the info above.

Personalized health guidance

Personalized Plan Generated by Multi-agent Health Coach MedlinePlus • Evidence-informed

POSSIBLE TREATMENTS

Step	Action	Rationale
1. Seek urgent care	If chest pain is crushing, radiates to arm/neck, or is accompanied by sweating, dizziness, or severe shortness of breath, call 911 or go to the ER.	These are red-flag signs of cardiac or pulmonary embolism.
2. Outpatient evaluation	Schedule a primary-care visit or urgent-care appointment within 24 h.	A clinician can order a chest X-ray, CBC, CRP/ESR, and ECG to rule out pneumonia, heart failure, or other causes.
3. Medications	<ul style="list-style-type: none"> • Bronchodilator (e.g., albuterol inhaler) if wheezing or asthma history. • Antibiotic only if bacterial pneumonia is confirmed. • Antiviral (e.g., oseltamivir) if influenza is suspected and within 48 h of symptom onset. 	Targeted therapy based on diagnosis.
4. Follow-up	Re-evaluate in 48–72 h if symptoms worsen or do not improve.	Early detection of complications.

COMPARISON TO PAST

- **Similarities:** Shortness of breath and cough have appeared before; asthma was considered previously.
- **Differences:** Current episode includes chest pain and severe congestion, suggesting a possible infectious or inflammatory process rather than a pure asthma flare.

NEXT STEPS

1. **Immediate:** If chest pain is severe or you feel faint, seek emergency care.
2. **Within 24 h:** Arrange an outpatient visit for diagnostic testing (X-ray, labs, ECG).
3. **Daily:** Record symptoms; note any new triggers or changes.
4. **Follow-up:** If symptoms improve, continue supportive care; if they persist or worsen, revisit the clinician.

REFERENCES

- <https://medlineplus.gov/breathingproblems.html>
- <https://medlineplus.gov/cough.html>
- <https://medlineplus.gov/chestpain.html>

(These URLs were provided in the reference snippets and are consistent with evidence-based guidelines.)

Plan II

7. CONCLUSION & LIMITATION

This project demonstrates an advanced multi-agent RAG system capable of integrating unstructured medical text with structured knowledge-graph data. The architecture is modular, scalable, and safe, ensuring that users receive contextual, evidence-based, and explainable health information. In terms of limitations, we would have to conform to HIPPA guidelines. Knowledge graph querying requires specific symptoms to retrieve accurate results, generic queries give a greater number of node matches, which are difficult to process by LLM.

APPENDIX

Personal Health Coach Outputs

Case1: Acute diarrhea

===== HEALTH
 RECOMMENDATIONS
 ===== PATIENT
 CONTEXT

- **Name:** Saud Ahmed
- **Age:** 28 years
- **Sex:** Male
- **Visit status:** First recorded visit (no prior consultations in the system).
- **History:** No past medical or medication history is stored; this is the first encounter.

CURRENT SYMPTOMS ANALYSIS

- **Duration:** 1 day
- **Primary complaints:**
 - Increased frequency of bowel movements/excretions (diarrhea)
 - Abdominal pain/tummy aches
- **Severity:** Not specified; patient reports “unknown” severity.
- **Associated symptoms:** None reported (no fever, blood in stool, vomiting, weight loss, etc.).

POSSIBLE CONDITIONS *(based on symptom cluster and medical knowledge)*

Likely diagnosis	Why it fits	Key distinguishing features
Acute gastroenteritis	Sudden onset of diarrhea and abdominal pain; common in adults after food or water exposure.	Often accompanied by nausea, vomiting, low-grade fever; resolves within 3–5 days.
Irritable bowel syndrome (IBS)	Chronic abdominal pain with altered bowel habits; can flare up suddenly.	Pain improves with bowel movements; no fever or blood; usually >6 months of symptoms.

Food intolerance or allergy	Certain foods can trigger rapid bowel movements and cramping.	Symptoms appear shortly after ingestion of trigger food; no systemic signs.
Traveler's diarrhea / bacterial infection	If recent travel or exposure to contaminated food/water.	Often watery stools, possible cramps, sometimes fever.

LIFESTYLE RECOMMENDATIONS

1. **Hydration** – Sip clear fluids (water, oral rehydration solution, broth).
2. **Dietary adjustments** –
 - a. Avoid spicy, fatty, fried, and high-fiber foods until symptoms improve.
 - b. Reintroduce bland foods (rice, bananas, toast, applesauce) gradually.
3. **Probiotics** – Consider a probiotic supplement or yogurt with live cultures to help restore gut flora.
4. **Hand hygiene** – Wash hands thoroughly with soap and water, especially before meals and after bathroom use.
5. **Avoid alcohol and caffeine** – These can worsen diarrhea.
6. **Monitor stool** – Note color, consistency, presence of blood or mucus.

POSSIBLE TREATMENTS

Option	When to use	Notes
Oral rehydration solution (ORS)	Every time you have a bowel movement or feel thirsty.	Prevents dehydration; follow package instructions.
Over-the-counter antidiarrheal (e.g., loperamide)	If diarrhea is frequent (>3 times/day) and not accompanied by fever or blood.	Do not use if you suspect bacterial infection with fever or bloody stools.
Antibiotics	Only if a bacterial infection is confirmed (e.g., positive stool culture) or if symptoms persist >3 days with fever.	Requires prescription.
Prescription medications	For IBS (e.g., antispasmodics, low-dose tricyclic antidepressants) if symptoms recur chronically.	Not indicated for acute episode.

Medical evaluation	If you develop: fever >38 °C, blood/mucus in stool, severe abdominal pain, signs of dehydration (dry mouth, dizziness, decreased urine).	Seek urgent care or ER.
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COMPARISON TO PAST

- This is Saud's first recorded visit; no prior symptom patterns or chronic conditions are available.
- Future visits will allow us to track recurrence, duration, and response to interventions.

NEXT STEPS

1. **Self-monitor** for the next 48–72 hours.
2. **Follow the lifestyle and OTC recommendations** above.
3. **Seek medical care** if:
 - a. Symptoms last >3 days.
 - b. Fever >38 °C develops.
 - c. Blood or mucus appears in stool.
 - d. Severe abdominal pain or signs of dehydration occur.

REFERENCES

- MedlinePlus: "Diarrhea" – <https://medlineplus.gov/diarrhea.html>
- MedlinePlus: "Constipation" – <https://medlineplus.gov/constipation.html>
- MedlinePlus: "Irritable Bowel Syndrome" – <https://medlineplus.gov/ibs.html>
- MedlinePlus: "Oral Rehydration Solution" – <https://medlineplus.gov/ors.html>

Case 2: Cough + fever (4 days)

=====

HEALTH RECOMMENDATIONS

=====

PATIENT CONTEXT

- **Name:** John Doe
- **ID:** P-JOHND0-202512010231
- **Age/Sex:** 36 y, Male
- **Visit Status:** First recorded visit (no prior history in the system).

- **Current Symptom Snapshot:** “Whooping cough” (pertussis) with a fever of ~101 °F and fatigue.

CURRENT SYMPTOMS ANALYSIS

- **Primary complaint:** Persistent cough that produces a “whooping” sound, especially after coughing fits.
- **Associated symptoms:** Low-grade fever (~101 °F), generalized fatigue, possible mild chills.
- **Duration:** Not specified, but typical pertussis courses last 2–4 weeks in the paroxysmal phase.

POSSIBLE CONDITIONS

Condition	Key Features	Why it fits
Pertussis (whooping cough)	Severe coughing fits, “whooping” sound, post-tussive vomiting, low-grade fever, fatigue	Classic presentation; fever and fatigue are common in early to paroxysmal stages.
Upper respiratory viral infection (e.g., influenza, RSV)	Fever, cough, fatigue	Fever and fatigue overlap, but the whooping sound is less typical.
Bacterial pneumonia	High fever, chills, productive cough, chest pain	Fever present, but cough is usually productive and less “whooping.”

LIFESTYLE RECOMMENDATIONS

1. **Hydration & Rest** – Aim for 8–10 cups of water/fluids daily; rest when fatigued.
2. **Humidified Air** – Use a cool-mist humidifier or inhale steam to soothe the airways.
3. **Avoid Irritants** – Stay away from smoke, strong fragrances, and dust.
4. **Nutrition** – Balanced meals rich in fruits, vegetables, lean protein, and whole grains to support immune function.
5. **Hand Hygiene** – Wash hands frequently to reduce spread to others.
6. **Vaccination Reminder** – If not already up-to-date, consider the Tdap booster (recommended every 10 years for adults).

POSSIBLE TREATMENTS

Step	Action	Rationale	Notes
Antibiotic therapy	Start macrolide (azithromycin 500 mg PO daily for 7 days) if	Reduces bacterial load and transmission.	If allergic to macrolides, consider

	within 7–10 days of symptom onset.		doxycycline (not for pregnant women).
Cough suppression	Use dextromethorphan 10 mg every 4 h PRN for cough control.	Helps reduce coughing fits and fatigue.	Avoid in severe cough or if patient has liver disease.
Supportive care	Paracetamol/acetaminophen 500 mg every 6 h PRN for fever and discomfort.	Lowers fever, improves comfort.	Do not exceed 4 g/day.
Monitoring	Check temperature twice daily; note any worsening cough, chest pain, or shortness of breath.	Early detection of complications (e.g., pneumonia).	Seek care if symptoms worsen or new symptoms appear.
Follow-up	Re-evaluate in 7–10 days or sooner if symptoms persist beyond 4 weeks.	Pertussis can last up to 10 weeks; monitoring ensures resolution.	

COMPARISON TO PAST

- No prior visits recorded; this is the first documented encounter.

NEXT STEPS

1. **Initiate antibiotic therapy** (azithromycin) today.
2. **Begin supportive measures** (hydration, humidifier, rest).
3. **Monitor:** If fever >102 °F, cough worsens, or you develop chest pain, shortness of breath, or vomiting, seek urgent care.
4. **Follow-up:** Schedule a virtual or in-person check-in in 7 days to assess response to treatment.

REFERENCES

- <https://medlineplus.gov/fever.html>
- <https://medlineplus.gov/breathingproblems.html>
- <https://medlineplus.gov/chestpain.html>

Case 3: One-sided headache + light sensitivity

===== HEALTH
RECOMMENDATIONS

===== PATIENT
CONTEXT

- **Patient ID:** P-FUSIAW-202512010257
- **Name:** Fusia Wang
- **Age:** 17 years
- **Sex:** Female
- **Return status:** First visit – no prior medical history recorded in our system.

CURRENT SYMPTOMS ANALYSIS

- **Primary complaint:** Intermittent pain on the entire left side of the body (could involve chest, abdomen, arm, or back).
- **Timing:** Comes and goes, no clear trigger reported.
- **Associated symptoms:** None reported at this time (no fever, shortness of breath, nausea, rash, etc.).

POSSIBLE CONDITIONS

Likely Condition	Why it fits	Key distinguishing features
Musculoskeletal strain or myofascial pain	Pain localized to one side, intermittent, often related to activity or posture.	Pain worsens with movement or prolonged standing; improves with rest or heat.
Intercostal neuralgia	Pain along the ribs on one side, can be intermittent.	Sharp, shooting pain that may be triggered by coughing or deep breathing.
Left-sided cardiac issues (e.g., pericarditis, myocarditis)	MedlinePlus references mention left-side heart problems.	Often accompanied by chest pressure, shortness of breath, or fatigue; pain may worsen with lying flat.
Left-sided abdominal pathology (e.g., gastritis, diverticulitis)	Pain can be diffuse on one side.	May be associated with eating, bowel habits, or abdominal tenderness.
Left-sided nerve compression (e.g., cervical radiculopathy)	Pain can radiate to arm or shoulder on one side.	Often worsens with neck movement or certain positions.

Psychogenic or stress-related pain	Intermittent, no clear organic cause.	Pain may fluctuate with emotional state or stress levels.
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LIFESTYLE RECOMMENDATIONS

1. **Posture & ergonomics** – Ensure proper sitting/standing posture; use supportive chairs and take short breaks every 30 min.
2. **Gentle stretching & mobility** – Light stretches for the neck, shoulders, and back can relieve muscle tension.
3. **Heat/ice therapy** – Apply a warm compress or cold pack (15–20 min) to the painful area, whichever feels more soothing.
4. **Hydration & nutrition** – Adequate water intake and a balanced diet help muscle function and reduce inflammation.
5. **Stress management** – Practice deep-breathing, mindfulness, or gentle yoga to reduce muscle tension and pain perception.
6. **Sleep hygiene** – Use a supportive mattress and pillow; avoid sleeping on the affected side if it worsens pain.

POSSIBLE TREATMENTS

Step	What to do	Why it helps
Self-monitoring	Keep a pain diary (time, intensity, activities, triggers).	Identifies patterns and potential triggers.
Over-the-counter pain relief	Ibuprofen or acetaminophen (as per dosing guidelines).	Reduces inflammation and pain.
Physical therapy referral	If pain persists >2 weeks or worsens.	Targeted exercises and manual therapy can address musculoskeletal causes.
Cardiac evaluation	If you develop chest pressure, shortness of breath, or palpitations.	ECG, echocardiogram, or blood tests to rule out heart issues.
Abdominal imaging	If pain localizes to the abdomen or is accompanied by GI symptoms.	Ultrasound or CT can identify organ pathology.
Neurological assessment	If pain radiates to arm/hand or is accompanied by numbness.	EMG or nerve conduction studies may be indicated.

COMPARISON TO PAST

- No prior visits or documented conditions; this is the first recorded episode.

NEXT STEPS

1. **Observe for red-flag symptoms** – If you notice chest pain, shortness of breath, fainting, severe abdominal pain, or sudden swelling, seek emergency care (call 911).
2. **Schedule a primary care appointment** – Within 1–2 weeks to discuss pain diary, review lifestyle changes, and consider imaging or specialist referral if pain persists.
3. **Follow up** – If pain improves with self-care, re-evaluate after 2 weeks; if it worsens or new symptoms appear, contact your provider sooner.

REFERENCES

- MedlinePlus: [Heart Surgery](#) – discusses left-side heart conditions.
- MedlinePlus: [Left-Side Heart Problems](#) – overview of left-sided cardiac issues.
- MedlinePlus: [Hand Injuries and Disorders](#) – potential musculoskeletal causes.

Case 4: Chest tightness on exertion

===== HEALTH
RECOMMENDATIONS
===== PATIENT
CONTEXT

- **Patient:** Erika Steward (ID P-ERIKAS-202512010302)
- **Age/Sex:** 42 y, female
- **Visit History:** First recorded visit. No prior conditions or recommendations in the system.
- **Current Symptom:** Shortness of breath lasting ~1 week.

CURRENT SYMPTOMS ANALYSIS

- Onset: One week ago, progressive shortness of breath.
- No accompanying chest pain, fever, cough, or orthopnea reported.
- No known triggers or exacerbating factors mentioned.

POSSIBLE CONDITIONS

Likelihood	Condition	Key Features	Why it fits
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Asthma	Variable airflow obstruction	Wheezing, reversible obstruction on spirometry	Common in adults, can present with isolated dyspnea
Heart-related causes (e.g., heart failure, arrhythmia)	Reduced cardiac output	Dyspnea, fatigue, possible edema	Heart failure can manifest as exertional dyspnea
Anxiety / panic	Hyperventilation, chest tightness	Rapid breathing, anxiety, no objective lung disease	Anxiety is a frequent cause of unexplained dyspnea
Pulmonary hypertension	Elevated pulmonary arterial pressure	Progressive dyspnea, may be silent initially	Rare but serious; requires evaluation
Respiratory infection (e.g., viral bronchitis)	Inflammation, mucus production	Recent upper-respiratory symptoms, fever	Could cause transient dyspnea

LIFESTYLE RECOMMENDATIONS

1. **Symptom Diary** – Record daily breathing difficulty, triggers, activity level, and any associated symptoms.
2. **Avoid Triggers** – Stay away from smoke, strong odors, cold air, and allergens.
3. **Breathing Exercises** – Practice diaphragmatic breathing or pursed-lip breathing to improve ventilation.
4. **Hydration & Nutrition** – Keep well-hydrated; maintain a balanced diet to support overall health.
5. **Stress Management** – Incorporate relaxation techniques (mindfulness, gentle yoga) to reduce anxiety-related dyspnea.
6. **Physical Activity** – Gentle walking or low-impact exercise as tolerated; avoid overexertion until evaluated.

POSSIBLE TREATMENTS / EVALUATION

Step	Action	Rationale
1	Spirometry	Detects reversible airflow limitation (asthma).
2	ECG & Chest X-ray	Screens for cardiac or pulmonary structural causes.
3	Pulse Oximetry	Quick assessment of oxygen saturation at rest and during exertion.

4	Referral to Pulmonology / Cardiology	If tests are abnormal or symptoms persist.
5	Medication Trial (if indicated)	Short-acting bronchodilator for asthma; anxiolytics for anxiety.
6	Follow-up	Re-evaluate after 2–4 weeks or sooner if symptoms worsen.

COMPARISON TO PAST

- This is Erika’s first recorded visit; no prior conditions or treatments to compare.

NEXT STEPS

- **Schedule an appointment** with your primary care provider within the next 7–10 days.
- Bring the symptom diary and any recent health changes.
- If you experience sudden chest pain, fainting, severe shortness of breath, or swelling, seek emergency care immediately.

REFERENCES

- MedlinePlus: “Shortness of breath” – <https://medlineplus.gov/shortnessofbreath>
- MedlinePlus: “Asthma” – <https://medlineplus.gov/asthma>
- MedlinePlus: “Heart failure” – <https://medlineplus.gov/heartfailure>
- MedlinePlus: “Anxiety” – <https://medlineplus.gov/anxiety>
- MedlinePlus: “Pulmonary hypertension” – <https://medlineplus.gov/pulmonaryhypertension>