Effectiveness of AI in Identifying Long COVID Symptoms

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Abstract

During the COVID-19 pandemic, there were many patients who had prolonged symptoms, even if they had mild or asymptomatic acute COVID-19. This post infectious disease is called long COVID. Not much is known about its symptoms, but there have been some reviews and studies about it. Although COVID-19 was initially thought of as being only a respiratory disease, it is a multisystemic one. COVID-19 affects the neurological system through cognitive impairment; the cardiovascular system through arrhythmia; the gastrointestinal system through gastroenteritis; the musculoskeletal system through myalgia; and the reproductive system through dysmenorrhea and fertility. Long COVID is also associated with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), postural orthostatic tachycardia syndrome (POTS), and Middle East respiratory syndrome (MERS). Artificial intelligence (AI) has been on the rise in the last few years, especially since the release of ChatGPT. This review seeks to explore the potential usage of AI to find patterns in healthcare, specifically symptoms of long COVID.

Introduction

Long COVID is a post-infectious disease that occurs in patients who had COVID, regardless of the initial severity of SARS-CoV-2, including asymptomatic patients. There isn't much known about its symptoms, as there are a large variety, making it difficult to pinpoint these symptoms and test for it, as long COVID lacks a universally acceptable definition[2,3,5-7]. Long COVID is a multisystemic disease, so the papers about it have many different symptoms listed. It affects the neurological system through cognitive dysfunction[1,2,4-8], concentration difficulties[1,3,4,7,8], dementia[1], encephalitis[2,4], seizures[1,2,4], and tinnitus[1] due to neuroinflammation[6], reactivation of viruses (e.g., Epstein-Barr virus (EBV) and HHV-6)[1,4], and Post-Intensive Care Syndrome (PICS)[3]. Within the cardiovascular system, it causes palpitations[2,3,5,6,8], tachycardia[3,8], and arrhythmia via Postural Orthostatic Tachycardia Syndrome (POTS)[6]. In the gastrointestinal system, it causes abdominal pain/discomfort[1,3,5,7,9], diarrhea[2,3,5,8,9] and loss of appetite[1,3,5,9] through dysbiosis[1,3,6,8,9] and long-lasting inflammation[6].

It is difficult to easily put together information from several papers to find common symptomatology.

Artificial Intelligence (AI) can help analyze many papers at once. AI, a tool that can be trained using a data set and tested using another to perform a certain task, where it

will be given different data[10], has grown significantly in the last few years. For example, NotebookLM, developed by Google Labs, has the user provide sources and uses these to respond to the user's prompts, such as summarizing what articles say.[11] ChatGPT, developed by OpenAI, doesn't need sources to respond to prompts, but if it is provided some, it will seek answers from there.[12] ChatGPT can search for the answer across the web.[13]

This review seeks to provide some common symptoms of long COVID, which should be readily available to treat when patients arrive before assessing individual needs using AI. This review will compare NotebookLM and ChatGPT to test for what is overall better to use based on factors such as time taken, accuracy, and easiest to read.

Table 1. Symptoms of long COVID

General	Body aches[1,7]
	Chills[3,7]
	Ear pain[2,3]
	*Fatigue[1-3,5-9,14]
	Fever[5,8,9]
	Flushing[3]
	Hair loss[2,3,5,8]
	Hoarseness[2]
	Inflammation[8,9]
	Pain[1,5,7]
	Pernio[3]
	Physical exhaustion[1,9]
	*Post-exertional malaise[1,6-8,14]
	Rhinorrhea (runny nose)[2,3]
	Skin rash[5]
	Sneezing[2]
	Sore throat (pharyngalgia)[2,5,7]
	Sputum[3]
	Thirst[14]

	Tremors[2]
	Weight loss[5]
	Wheezing[3]
Respiratory	*Chest pain[1-3,5-7,14]
	*Cough[1-3,5,6,9,14]
	*Dyspnea (shortness of breath)[1-3,5-9,14]
	Tachypnea (rapid breathing)[8]
Neurological and Cognitive	*Ageusia (absence of sense of taste)[4-9]
	Amnesia (memory loss)[1-3,7]
	*Anosmia (absence of sense of smell)[3-9]
	Autonomic dysfunction[1]
	Balance issues[1]
	*Cognitive dysfunction/impairment (“brain fog”)[1,2,4-8,14]
	*Concentration difficulties[1,3,4,7,8]
	Dementia[1]
	Dizziness[1,8,14]
	*Dysgeusia (altered sense of taste)[1-3,5,7-9,14]
	*Dysosmia (altered sense of smell)[1-3,5,7-9,14]
	Encephalitis[2,4]
	*Headache[1-5,7-9]
	Hearing loss[1,2,5]
	*Insomnia[1-3,5-8]
	Loss of (or phantom) smell or taste[1,3,7]
	Memory issues[1,4,7,8]
	Orthostatic intolerance[1]
	Paresthesia[1,8]
	Psychosis[1]

	Seizures[1,2,4]
	Sensitivity to light and noise[1]
	Sensorimotor symptoms[1]
	Tinnitus (ringing in ears)[1]
	Vertigo[1]
	Visual impairments[3]
Cardiovascular	*Palpitations (awareness of heartbeat)[2,3,5,6,8,14]
	Tachycardia[3,8]
Gastrointestinal	*Abdominal pain/discomfort[1,3,5,7,9]
	Bladder incontinence[2,7]
	Bloating[8]
	Constipation[1,8]
	*Diarrhea[2,3,5,8,9]
	Dysphagia (difficulty swallowing)[9]
	Heartburn[1]
	Liver injury[1]
	Loss of appetite[1,3,5,9]
	*Nausea[1,3,5,8,9]
	Vomiting[3,5,8,9]
Musculoskeletal	*Joint pain (arthralgia)[2,3,5-8]
	Muscle pain[5-8]
	Myalgia[2,3,7,8]
Psychological and Mental Health	*Anxiety[1-6,8,9]
	*Depression[1-6,8]
	Mental exhaustion[1]
	Mood swings[2,7]
	PTSD[2,5,6]

	Thoughts of self-harm and suicide[2]
Endocrine and Metabolic	Diabetes[2]
Reproductive	Erectile dysfunction[1,8]
	Menstrual irregularities[1,8]
	Reduced sperm count[1,8]

Long COVID can affect many systems through a variety of symptoms. Symptoms marked with an asterisk (*) were found in more than half of the studies reviewed.

Methodology

Long COVID reviews with free full texts from 2020 to the present were found on NCBI, as 2020 is when COVID-19 started becoming a major issue. Nine reviews from March of 2021 to December of 2024 were chosen and were narrowed down to three sets of three, as ChatGPT's file limit was three per message.

The first review was more compact. As file size could've been an issue, the other two chosen reviews contained less text. The chosen reviews were meant to be shorter in word count and more concise to make it more convenient for the AI to analyze and summarize them.

After opening the first set of three reviews and reading through each one, notes were made on a separate document to check against the AIs' responses.

After reading and taking notes, prompts were written on a separate document to ask AI, such as what commonalities are in the papers, what the symptoms of long COVID are, and what outliers there are between the three papers. These three documents were uploaded to NotebookLM and the prompts were pasted. This process was repeated with ChatGPT. The prompts are listed below and asked in that order.

1. What do these papers have in common?
2. What symptoms did long COVID patients have?
3. Identify differences and outliers

This process was repeated with the second and third sets of three reviews as well. The process with the first set was done on February 9, 2025, the second set on February 22, and the third on May 17.

Findings

NotebookLM vs ChatGPT

When NotebookLM was used, it was accurate when summarizing the research papers, common symptoms, and outliers. ChatGPT's responses were more generalized and contained some sources other than what was given. However, ChatGPT also categorized the given symptoms, which tended to be similar, rather than just listing them out. ChatGPT summarized the correct information with the wrong source titles. Figure 1 compares NotebookLM and ChatGPT.

Symptoms

Very common symptoms of long COVID include fatigue[1-3,5-9], dyspnea[1-3,5-9], joint pain[2,3,5-8], headache[1-5,7-9], cough[1-3,5,6,9], chest pain[1-3,5-7], anosmia[3-9], and dysgeusia[1-3,5,7-9]. Some other symptoms are post-exertional malaise[1,6-8], encephalitis[2,4], loss of appetite[1,3,5,9], and more is detailed in Table 1.

Figure 1. ChatGPT vs NotebookLM

	ChatGPT	NotebookLM
UI/visuals	☑ Larger headings ☑ Bolded important text or symptoms ☑ Bulletpoints/sentence fragments	☐ Larger headings ☑ Bolded important text or symptoms ☐ Bulletpoints/sentence fragments
Accuracy	☑ Content ☐ Sourcing/citations	☑ Content ☑ Sourcing/citations
Time* *Used prompts listed in methodology and sources from references, measured with a stopwatch	1:23.25 (27.75 sec / prompt)	1:19.71 sec (26.57 sec / prompt)
Max # of sources	3 per prompt	50 total
Overall score	4/5	3/5

Different AI models have different strengths and weaknesses. Criteria comparing ChatGPT and NotebookLM are given.

Conclusion

Long COVID, a post-infectious disease in COVID-19 patients, has varying symptoms from patient to patient, making it difficult to discern which symptoms are specific to the disease.

Both NotebookLM and ChatGPT are good for accurately analyzing and summarizing sources, such as long COVID symptomatology. For more than three sources, NotebookLM is better, as it can handle up to fifty sources, but ChatGPT makes data easier to read. Both AI can identify common symptoms, shown in Table 1, and identify differences in the given sources, such as a lack of a universally accepted definition[2,3,5-7], varying levels of detail, and outliers, such as symptoms appearing in only a few studies.

This approach to AI can be used with more specific details, such as the location the studies used took place in, to compare symptom frequency within different communities.

These findings demonstrate that AI are efficient and mostly accurate at summarizing and analyzing studies, but results may vary based on the model and sources given.

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