

The Accuracy of WebMD Symptom Checker for Diagnosis of COVID-19 in Admitted Patients in Imam Hassan Hospital of Bojnurd

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Abstract

Background: Coronavirus has caused rapid disruption to daily life with significant morbidity and mortality. The infection spreads mainly through respiratory droplets expelled by infected individuals. Several web-based symptom checkers have been used to avoid unnecessary in-person visits during the pandemic. WebMD's symptom checker contains a course of multiple-choice questions about symptoms. At last, a record of differential diagnoses is assembled.

Methods: This study chose 105 hospitalized patients in the isolation ward. We entered the data about symptoms and comorbidities in the WebMD symptom checker to find the most probable diagnoses proposed by the website for 66 patients whose polymerase chain reaction (PCR) test was positive and investigated the frequency of initial symptoms, present symptoms, and chief complaints.

Results: The average age was 47.41 ± 13.52 . Of 66 patients, 23 were correctly diagnosed with coronavirus disease 2019 (COVID-19) as the first diagnosis with the WebMD symptom checker. In 41 cases, COVID-19 was one of the three main diagnoses. The most common initial symptoms were fever in 24%, sore throat in 12%, and myalgia in 12% of patients. The most common chief complaints were fever in 34% and dyspnea in 28% of patients. The most common present symptoms were myalgia in 81%, fever in 80%, fatigue in 75%, and dyspnea in 72% of patients.

Conclusions: WebMD symptom checkers can act as a first tool first, to diagnose and, second, to avoid in-person physician visits. Moreover, it can be used for the first diagnosis in primary care health organizations. Myalgia can be considered one of the most common present symptoms.

Keywords: COVID-19; WebMD; Symptom Checker

1. Background

The initial coronavirus disease 2019 (COVID-19) case was recognized in Wuhan, China. The World Health Organization (WHO) was notified about the outbreak on December 31, 2019, and later, on March 11, 2020, declared that COVID-19 fit the criteria for a pandemic. COVID-19 is the name of the disease, but from a scientific point of view, the accurate name of the virus is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus has caused rapid disruption to daily life along with significant morbidity and mortality on a global scale (1-4). The range of clinical symptoms of the disease varies from asymptomatic to conditions including multiorgan and systemic manifestations in terms of septic shock and multiple organ dysfunction syndromes (5). Symptoms can be respiratory (e.g., cough, dyspnea) or systemic (e.g.,

dizziness, weakness, nausea/vomiting). Typical symptoms encompass fever, cough, sore throat, headache, myalgia, fatigue, and breathlessness. 18% to 43% of infected people remain asymptomatic and have no symptoms (6, 7). It is now well established that infection spreads mainly through respiratory droplets expelled by infected individuals while breathing, sneezing, coughing, or simply speaking (8). One of the best ways to withstand the spread of COVID-19 is the public practice of social distancing which is crucial for flattening the curve of coronavirus spread (9). In the actual office setting, all social distancing practices should be in place, including limiting the number of people in the waiting room, allowing one person in each examination room, and requiring all personnel and patients to wear masks (10). Healthcare pro-



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viders are left in difficult circumstances, abandoning the traditional face-to-face clinic visits to protect the patient, provider, and staff (11).

Healthcare systems have been challenged by this pandemic, as the disease has spread rapidly, exceeding hospital capacity and putting healthcare workers at risk. Patients and other HCWs can also contract infections from infected HCWs (12).

Early in the pandemic, the public healthcare sector promoted physical distance and encouraged patients with suspected illnesses or exposure to self-quarantine (13). Also, measures were taken to prevent SARS-CoV-2 from being transmitted to healthcare workers. In addition to providing adequate training for HCWs, monitoring compliance with infection control policies and procedures, and implementing measures to minimize contact with COVID-19 patients, administrative controls include accurate triage, early detection of suspected patients, source control, and adequate training for HCWs (14-16).

COVID-19 must be identified early, risk evaluated appropriately, isolated, and prevented from spreading (17).

Therefore, it is imperative to look for a way to quickly recognize infected patients and isolate them from other patients in isolation wards in hospitals.

Today, despite the potential harms of Internet-based self-diagnoses and the importance of cooperation and trust in the patient-physician relationship, large numbers of patients initially turn to a variety of web-based sources for self-diagnoses of health concerns before seeking diagnoses from a trained medical professional. However, web-based sources have essential problems, such as misunderstandings, misinformation, misleading advertisements, and varying quality (18). Given the importance of avoiding unnecessary in-person visits amid the pandemic, several mobile health apps and web-based symptom checkers have been playing an important role in diminishing the COVID-19 spread. These tools are employed since the surge of patients walking into urgent and primary care and asking for advice creates an infection control hazard (19, 20). Web-based symptom checkers have become popular in the new COVID-19 pandemic, as access to physicians is reduced, and concern in the population is high (18). Symptom monitoring apps have also appeared in response to COVID-19. By asking questions related to symptom identification, these apps collect information about the user's health and provide a differential diagnosis (21). Some symptom checkers are not made specifically for any special disease. They contain a series of questions about symptoms, list probable differentiated diagnoses, and provide some recommendations. However, others focus on a special disease (e.g., COVID-19) that tells whether the case is suspect and do not list a series of differentiated diagnoses. Among all these exclusively designed mobile apps and web-based symptom checkers, the WebMD symptom checker was selected for this survey (last updated on July 31, 2020) (22). Although there was a unique version for COVID-19, the

general version used to diagnose different diseases was employed in this study.

WebMD presents a picture of the human body, and patients are asked to identify the areas where their symptoms are located. Then, they are invited to identify relevant symptoms (e.g., joint pain or swelling), and, depending on the symptoms selected, a series of multiple-choice questions are asked. In the end, a list of differential diagnoses is ready (23).

2. Methods

An observational survey was conducted, and a cross-sectional descriptive-analytical study was performed. In this study, 105 hospitalized patients in the isolation ward in Imam Hasan hospital (the health system care for COVID-19 issues) were chosen. Our researchers asked these patients a series of branched logic questions about symptoms and comorbidities soon after they were admitted to the hospital. Then, the polymerase chain reaction (PCR) test was carried out for all patients by intranasal sampling.

For the group whose PCR test was positive (66 patients), we entered the data into the WebMD symptom checker to find the most probable diagnoses proposed by the website.

We should note that due to the possibility of pseudo-negative cases among 39 patients whose PCR tests were reported negative, we excluded them from our study to avoid feasible bias.

Finally, we investigated the frequency of symptoms of PCR-positive patients to find the most common symptoms and symptoms that were initially present or brought the patients to the hospital as chief complaints (CC).

3. Results

Of the 66 patients enrolled, the average age was 47.41 ± 13.52 . Of 66 cases, 38 were men (52.52% with a minimum age of 22 years and maximum age of 75 years), and 28 were women (42.42% with a minimum age of 32 years and maximum age of 78 years).

Of the 66 patients whose information was entered into the WebMD symptom checker, 23 were correctly diagnosed with COVID-19 as the first diagnosis.

In 41 of the 66 cases, COVID-19 was one of the three main diagnoses. In 48 patients, COVID-19 was among the 5 main diagnoses.

In 63 patients, COVID-19 was among the 10 main diagnoses, while in all 66 cases, COVID-19 was among the top 15 diagnoses suggested by the system.

After careful examination of different symptoms, we obtained the following results:

The most common initial symptoms were fever in 16 (24%), sore throat in 8 (12%), myalgia in 8 (12%), and fatigue

in 7 (10%) patients.

The most common chief complaints for coming to the hospital were fever in 23 (34%), dyspnea in 19 (28%), and fatigue in 7 (10%) patients.

The most common present symptoms in patients when

coming to the hospital were myalgia in 54 (81%), fever in 53 (80%), fatigue in 50 (75%), and dyspnea in 48 (72%) patients.

Further information is given in the figures below (Figures 1, 2 and 3).

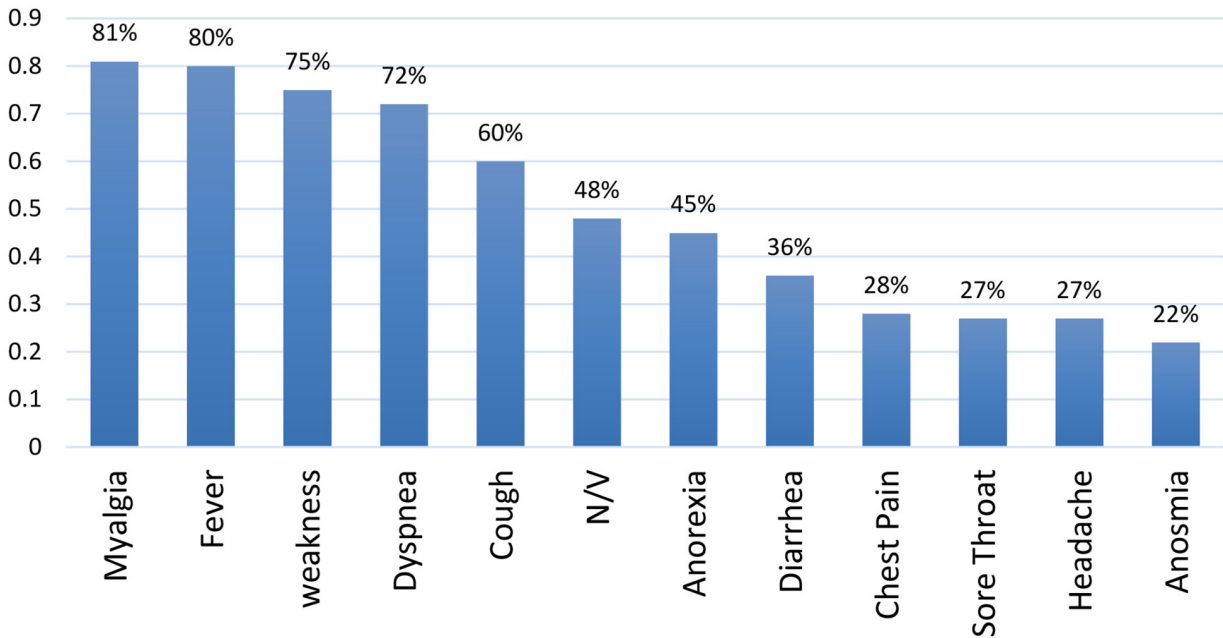


Figure 1. Frequency of symptoms in COVID-19 infected patients (percentage)

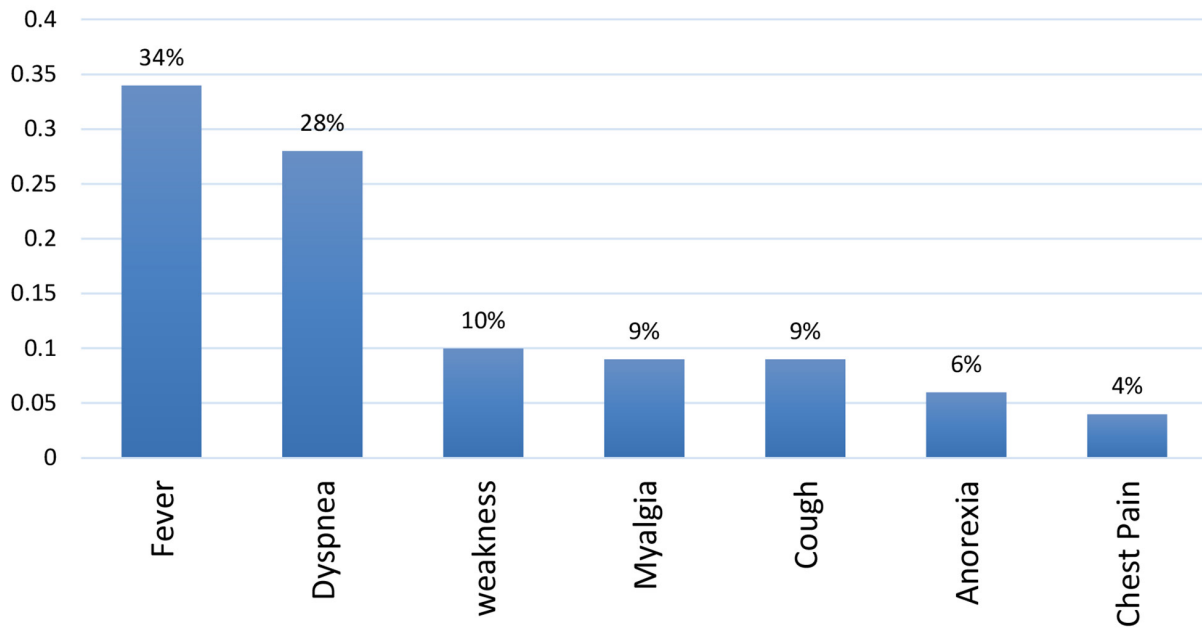


Figure 2. Chief complaint of COVID-19 infected patients (percentage)

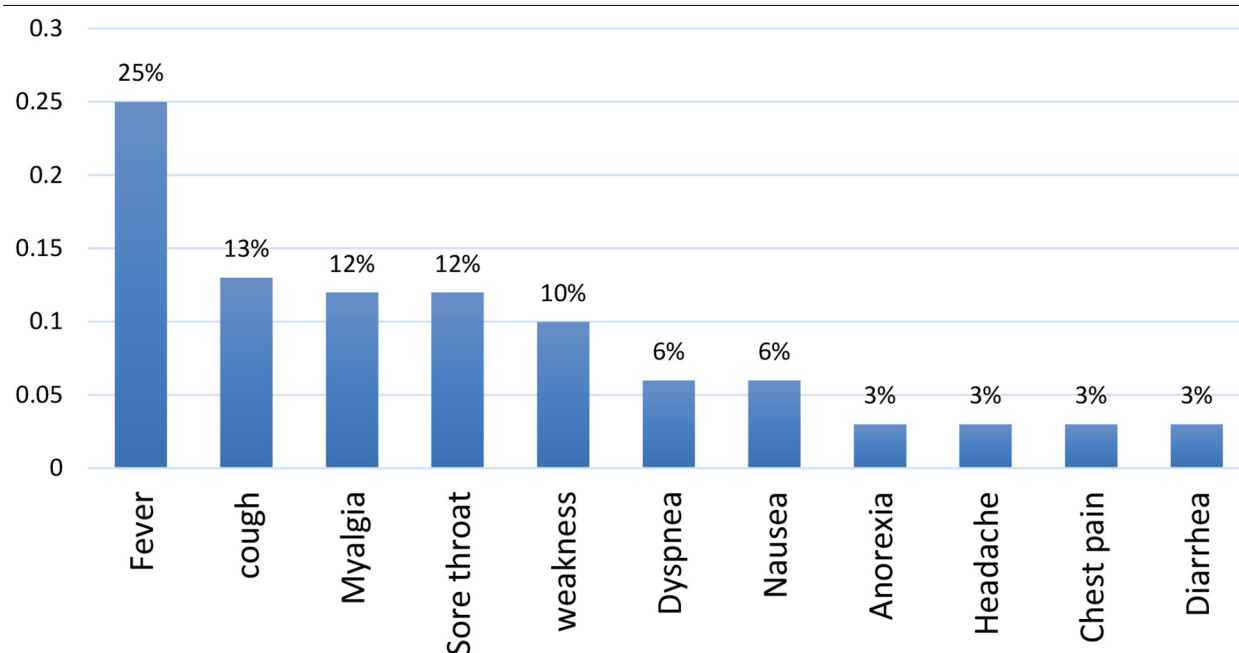


Figure 3. Initial symptom in COVID-19 infected patients (percentage)

In a research study of different risk factors, hypertension was observed in 22 (33%), obesity in 22 (33%), and diabetes mellitus in 12 (18%) patients. 20 (30%) of the cases

had no reported major comorbidity.

More information about patients' risk factors is provided in the following table (Table 1).

Table 1. Risk Factors Studied in COVID-19 Patients (N = 66)

Comorbidity	No. (%) (N = 66)
HTN	22 (33)
Obesity	22 (33)
DM	12 (18)
Lipid disorder	11 (17)
Opium consumption	10 (15)
COPD	9 (14)
IHD/previous MI	6 (9)
Smoking	4 (6)
CVA	2 (3)
Other comorbidities	7 (11)

² Abbreviations: HTN: hypertension; DM: diabetes mellitus. COPD: Chronic Obstructive Pulmonary Disease; IHD: Ischemic Heart Disease; MI: Myocardial Infarction; CVA: Cerebral Vascular Accident

4. Discussion

This study evaluated the efficiency of the WebMD symptom checker in the diagnosis of COVID-19. In all 66 cases, COVID-19 was among the top 13 diagnoses suggested by the system.

Shen et al. distilled a validated clinical vignette of 42 ophthalmic symptoms to its core presenting symptoms. The cases were entered into the WebMD symptom checker. 11 out of 42 cases were correctly diagnosed by the symptom checker. 16 of 42 cases had the correct diagnosis in the top 3 diagnoses listed by the online symptom

checker (24). The overall results were consistent with our study.

Based on 45 clinical vignettes representing several general medical conditions, Semigran et al. evaluated 23 symptom checkers. 34% of evaluations listed the correct diagnosis first, 51% listed the first three, and 58% listed the top 20 diagnoses (25).

In our study, the proper diagnosis was in the top 13 diagnoses in 100% of cases.

Using 10 different web-based COVID-19 symptom checkers, they categorized 50 COVID-19 case descriptions from the recent literature and 410 non-COVID-19 control cases.

In only two out of ten symptom checkers, sensitivity and specificity were in balance. Most others classified almost all COVID-19-positive patients as COVID-19-negative, or were either too sensitive or too specific in their classifications.

In this research study, we focused on suggested differentiated diagnoses and the sensitivity of the WebMD symptom checker to suggest COVID-19 for PCR-positive cases as the first probable diagnosis; due to the lack of a control group, we did not evaluate the specificity of this application (26).

In a cohort study, Bisson and colleagues found that with the aid of an accurate symptom checker, patients could correctly identify the cause of their knee pain 58% of the time (27). The number of correct diagnoses was lower in our study (34%).

Also, different symptoms and risk factors for COVID-19 were probed. Fever was the most common initial symptom and chief complaint. Myalgia was the most common present symptom.

In a previous research study, in 138 hospitalized patients with coronavirus-infected pneumonia, the common symptoms included fever (136 (98.6%)), fatigue (96 (69.6%)), and cough (82 (59.4%)) (28).

In the United States, Arentz et al. published characteristics and outcomes of 21 crucially ill patients with COVID-19. Initial symptoms included breathlessness (76%), fever (52%), and cough (48%) (29). In our research study, like the last two research studies, fever and fatigue were the most common initial symptoms.

Based on the first 425 confirmed and reported cases in Wuhan, the common symptoms include fever, dry cough, myalgia, and fatigue, and the less common are sputum production, headache, hemoptysis, abdominal pain, and diarrhea. This agrees with our research study, except that hemoptysis was not in any of our cases' symptoms (30).

In evaluating 20133 hospitalized patients with COVID-19, it was found that the most common comorbidities were chronic cardiac disease (31%, 5469/17702), uncomplicated diabetes (21%, 3650/17599), nonasthmatic chronic pulmonary disease (18%, 3128/17634), and chronic kidney disease (16%, 2830/17506). 23% (4161/18525) did not report any major comorbidities (31).

As in our research study, heart disease and diabetes are some of the most common risk factors, and 30% of cases had no risk factors.

One of the limitations of our study was that we excluded negative PCR cases and did not evaluate them to find the specificity of this application. As mentioned, this was due to the high possibility of pseudo-negative PCR tests.

It could also be argued that for a COVID-19 symptom checker, sensitivity (detecting positive tests) is more important than specificity (i.e., numerous false-positive COVID-19 diagnoses are not of concern as long as no COVID-19 infections are missed).

A potential weakness of this research study was that we focused only on admitted cases to evaluate the efficacy of

the application to isolate infected cases from other cases.

More research studies are suggested to evaluate the efficacy of different symptom checkers and evaluate other cases that are not indicated for admission but have positive PCR tests for COVID-19.

4.1. Conclusions

Based on our research study, WebMD as a web-based COVID-19 symptom checker, can be used as a first tool for diagnosing in order to avoid in-person physician visits and ease the pressure on hospitals. Also, they can be used for the first diagnosis in primary care health organizations to transfer patients suspected of having COVID-19 to the health systems care for COVID-19-positive patients with a more accurate guess. Nevertheless, further research studies on other symptom checkers are needed to determine more precise results about the effectiveness of symptom checkers in correctly diagnosing COVID-19.

Myalgia can be considered one of the most common present symptoms of the novel coronavirus infection.

Fever is not necessarily the initial symptom in every infected patient, and other symptoms such as sore throat, myalgia, and fatigue should be considered.

Among different comorbidities, hypertension (HTN), obesity, and uncomplicated diabetes can be counted as the most common risk factors.

These were the findings of the current research study; clearly, to be more certain about each finding, more research studies are needed.

We should note that in the case of COVID-19, a web-based assessment cannot fully replace a PCR test, as some people are asymptomatic while others present with very specific COVID-19 symptoms and may, in fact, have very similar symptoms, but they have different diseases.

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