

## REVIEW ARTICLE

# ASSESSMENT AND MANAGEMENT OF ADULT PATIENTS WITH AN ACUTE ASTHMA EXACERBATION DURING THE COVID-19 PANDEMIC

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## KEYWORDS:

Acute asthma exacerbation

COVID-19

SARS-CoV-2

Telemedicine

According to the most recent national data from the U.S. Centers for Disease Control and Prevention (CDC), asthma is a chronic respiratory disease that affects approximately 8%–9% of the U.S. population and roughly 300 million worldwide. CDC data from 2019 shows 3524 deaths from asthma as the underlying cause. During the COVID-19 pandemic, it has been challenging for healthcare providers to treat asthma exacerbations due to similarities in symptom presentation. Due to the high transmission rate of COVID-19, and variation in symptoms, many primary care providers have integrated telemedicine to deliver care. Utilizing telemedicine in the clinical setting integrates social distancing, reducing the exposure and transmission rate of COVID-19 while offering patients the ability to be examined. Although telemedicine can provide care for patients in remote areas, decrease travel time and deliver care for patients with COVID-19 symptoms, many healthcare providers and patients have not had much experience with this type of technology. The purpose of this article is to provide a framework that primary care providers can use to effectively screen, evaluate and treat patients with acute asthma exacerbations during the COVID-19 pandemic.

## INTRODUCTION

Asthma is a chronic respiratory disease that is estimated to affect 300 million individuals worldwide.<sup>1,2</sup> Within the United States, acute asthma exacerbations in adults account for 1.8 million hospitalizations and has a mortality rate of approximately 13.3 deaths per million.<sup>3</sup> Asthma management focuses on adequate symptom control assessment of future risk.<sup>2</sup> Recently, the SARS-CoV-2 virus, commonly known as COVID-19, can resemble symptoms of asthma exacerbations.<sup>4,5</sup> The World Health Organization (WHO) declared COVID-19 a global pandemic in early March 2020.<sup>4,6,7</sup> As of August 27, 2021, there have been 214,468,601 confirmed cases worldwide and 4,470,969 documented deaths.<sup>8</sup>

The virus responsible for COVID-19 is highly communicable, and its presentation varies from person to person.<sup>9</sup> While most patients exhibit mild-to-moderate symptoms, others require intubation and often die from complications.<sup>10</sup> COVID-19 infections can be difficult to recognize at times. Asymptomatic carriers can transmit to other people causing unknown harm.<sup>9,11</sup> In many cases, COVID-19 infections and acute asthma exacerbations were indistinguishable due to similar presentation of symptoms.<sup>11</sup>

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Both conditions may present with shortness of breath, dry cough and chest tightness, which has made it challenging for providers to treat patients with acute asthma exacerbations during the COVID-19 pandemic.<sup>12</sup>

About 80% of asthma exacerbations are related to viral infections. Recent studies show that asthma is not a risk factor for acquiring COVID-19 infection.<sup>4,7,13-17</sup> However, a few studies suggest asthma patients have an increased risk of COVID-19 co-infection.<sup>1,4,7,17</sup> It is questionable whether there is an overrepresentation of patients with asthma symptoms, as COVID-19 may trigger asthma exacerbations. The concern for patients with asthma is reasonable, as COVID-19 can infect upper and lower airways.<sup>13</sup>

Due to the high transmissibility and heterogeneous variance in symptoms, many providers have started using telemedicine to deliver healthcare services to patients with COVID-19-like symptoms.<sup>18-20</sup> Technological advancements have allowed clinicians to use audio or audiovisual communication methods to provide healthcare services remotely to minimize the possibility of exposure.<sup>18-21</sup> This has the potential of lowering infection rates by decreasing risk of disease propagation.<sup>18</sup>

The focus of this review article is to provide a framework for providers to use to effectively screen and triage individuals, examine, diagnose, and treat patients with acute asthma exacerbations. We also seek to provide insight into strategies for follow-up visits.

## SCREEN AND TRIAGE

### COVID-19 transmission

According to the WHO, as of August 27, 2021, there have been 214,468,601 confirmed cases documented worldwide.<sup>8</sup> When compared with other known coronaviruses, the COVID-19 virus has a higher transmission rate.<sup>22</sup> The COVID-19 virus enters and infects host cells by binding to the angiotensin-converting enzyme 2 (ACE2) receptor in the lung cells of its host.<sup>4,22</sup> Recent research suggests there may be reduced symptom severity in patients infected with COVID-19 who also have asthma.<sup>4</sup> It is hypothesized that reduced ACE2 expression in lung cells of asthma patients reduces viral entry which accounts for the decrease in symptom severity.<sup>4</sup> Cellular entry and viral replication of COVID-19 is theorized based on SARS-CoV and MERS-CoV-2 coronaviruses, which share genetic sequence similarities.<sup>5</sup> COVID-19 shows a higher transmission competence in comparison with the two previous coronaviruses mentioned.<sup>22</sup> In a research study conducted by the Severe Asthma Research Program-3, inhaled corticosteroid therapy was associated with decreased ACE2 expression in sputum samples.<sup>4</sup> This can potentially account for the decrease transmissibility of viral particles into hosts cells with asthma and emphasizes the importance of asthma treatment, which usually involves using inhaled corticosteroids.

### Screening for COVID-19 symptoms and triaging patients

Due to the high transmission rate of COVID-19, the WHO now recommends prescreening all individuals entering a healthcare facility to limit exposure and transmission. In addition, patients should be prescreened to limit the contact of medical staff and patients to anyone who is at high risk of being infected. Healthcare workers performing the screening questionnaires are recommended to wear a mask and be at a distance greater than 1 meter (slightly greater than 3 feet) from individuals being screened.

The U.S. Centers for Disease Control and Prevention (CDC) has developed a questionnaire that can be used to screen anyone entering a healthcare facility.<sup>23</sup> The questions assess whether individuals have experienced concerning symptoms such as fevers, chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, loss of taste or smell, sore throat, congestion or runny nose, nausea, vomiting, or diarrhea within the last 48 hours.<sup>23</sup> It also evaluates whether individuals have been in close contact—within 6 feet and for 15 or more minutes—of someone with known COVID-19 infection or have symptoms suggestive of infection in the last 2 weeks. The questions also ascertain whether the individual entering the facility has been quarantining because they believe they may be sick. Lastly, the questionnaire inquires whether the individual was recently tested for COVID-19 and if they are awaiting results. If the individuals answer yes to any of these questions, it is recommended they are not approved to enter the healthcare facility to minimize exposure to any staff or patients, which may result in them becoming potential COVID-19 carriers.<sup>23</sup>

The American Medical Association (AMA) has also created a prescreening template that shares many of the same questions

as the CDC, in addition to questions that evaluate whether the individual was recently hospitalized or if they have visited a nursing home, long-term care facility or healthcare facility in the last 30 days. It also asks if the individual or anyone in their household has traveled outside of the country and if the individual is a healthcare provider or an emergency responder.<sup>24</sup> Per AMA recommendations, if a person answers yes to any of these questions, a medical professional should review their case and use clinical judgment to determine whether the patient may keep their appointment and enter the facility.

After employing remote triage or in-person prescreening questions, providers should risk stratify patients and determine whether it is appropriate to have a face-to-face interview or telemedicine encounter based on screening questions discussed. For example, patients with acute asthma exacerbations will unlikely meet the criteria for an in-person visit, as they will likely exhibit shortness of breath, chest tightness or cough.

If at any point during the screening process the patient begins to exhibit trouble breathing, persistent chest pain or pressure, new confusion, inability to stay awake or cyanosis over the lips or face, they should receive emergency medical care immediately, as these can be signs of a life-threatening condition.<sup>11</sup>

Although many healthcare practices have instituted prescreening procedures with COVID-19 testing, there are no current global testing guidelines or recommendations in place. Accuracy of testing and COVID-19 infection stage impacts results. COVID-19 testing can be performed with reverse transcriptase-polymerase chain reaction (RT-PCR) or rapid antigen testing. RT-PCR has a sensitivity between 71%–98% and has a false negative rate between 2%–29%.<sup>25</sup> The accuracy of testing samples also is impacted by the quality and location of the sample obtained. Lastly, the stage of the COVID-19 infection also affects the reading. False-negative testing results could cause false reassurance; therefore, it is best to use clinical judgment.<sup>25</sup>

## TELEMEDICINE, EXAMINATION, TREATMENT AND FOLLOW-UP

### Telemedicine encounters

Telemedicine, or telehealth, is a form of delivering health care remotely through audio or audio-video interactions between providers and patients.<sup>19–21,26,27</sup> Telemedicine provides a cost-effective and convenient method of delivering healthcare services while reducing the exposure of potential infections to staff and other patients.<sup>20</sup> These virtual consultations have played a vital role during the COVID-19 pandemic to ensure continuity of care while reducing the risk of infection within the community. Conducting telemedicine encounters for patients with asthma has been particularly beneficial. In a meta-analysis conducted by McLean *et al*<sup>10</sup> randomized control trials demonstrated that telemedicine improved the quality of life for asthmatic patients.<sup>8</sup>

This form of healthcare service has increased since the onset of the COVID-19 pandemic. Before this pandemic, reports indicated that only 11.8% of family physicians and pediatricians practicing in the United States used telemedicine services as a part of their

practice.<sup>26</sup> Two months after the onset of the COVID-19 pandemic, this increased considerably, as only 9% of primary care physicians did not offer telemedicine visits to their patients.<sup>26</sup>

Physicians and other healthcare providers differ in their level of training with telemedicine. It can be challenging to implement telemedicine visits if either healthcare personnel or patients have not adequately trained to use software or telemedicine equipment.<sup>20,27</sup> With the rapid progression of the COVID-19 pandemic, telemedicine visits are often a new learning experience for many providers and patients as well. Although the telemedicine encounter may be as thorough as an in-person visit when obtaining a history of present illness, it still has limitations. By forgoing a face-to-face physical exam, a provider may miss minor cues from the patient and would be unable to perform in-office testing, such as peak expiratory flow, or imaging, such as a chest X-ray.<sup>12</sup> Relying on a digital method of communication impacts the provider-patient relationship, where the clinician or patient may appear to be dispassionate or distracted on the screen during the encounter. This perception can result in a loss of confidence by either party.<sup>3</sup>

It is important to note local, state and federal guidelines regarding telemedicine visits as they vary geographically. Laws should be followed according to jurisdiction.

### Patient history and symptom severity

Using open-ended questions, ask the patient to describe their symptoms and discuss what brings them in for evaluation.<sup>12</sup> While many of these symptoms may have been asked during the initial prescreening period, it is imperative to get a thorough history from the patient, as questions may have been missed or misunderstood.

As the patient responds to the questions, closely observe how they sound when they speak and note the tone of their voice. It is essential to pay close attention to whether they sound breathless or are struggling to complete sentences. This determines if they are in respiratory distress and whether immediate action is needed.<sup>12</sup> If the patient cannot complete sentences, or if the respiratory rate is greater than or equal to 25 breaths per minute, treat their condition as severe or life-threatening and seek immediate medical intervention. For patients with pre-existing asthma, ask if their symptoms feel like an asthma attack.<sup>12</sup> Figure out whether they have had any previous hospitalizations for asthma and whether their asthma symptoms are generally under control (eg, baseline asthma symptoms).<sup>2</sup> Inquire about their current medication usage. Review current medications they may be taking, including any inhaled or oral corticosteroids, long-acting beta-agonists, or combination inhalers. Next, determine whether they have been using their medications as prescribed or recommended. Use their history in conjunction with their symptoms to further risk stratify and assess the severity of the disease.<sup>2</sup> It is also imperative to ask the patient about any recent or new hospitalizations and to determine if they have an action plan already in place, while assessing the patient's understanding to implement said plan.<sup>2</sup>

COVID-19 symptoms are wide-ranging and include fever, dry cough, gastrointestinal symptoms (eg, nausea, vomiting, diarrhea), fatigue, myalgias, chest tightness, dyspnea, tachycardia, and headache.<sup>7,11,12,14,15,28</sup> Additionally, patients suffering from COVID-19 may also exhibit sore throat, loss of taste, ageusia and headaches.<sup>9,29</sup> According to the CDC, after exposure to the COVID-19 virus, symptoms may appear anytime between 2–14 days.<sup>11</sup> It is essential to recognize, however, that a single sign cannot diagnose or rule out COVID-19.<sup>29</sup>

In many cases, taking a thorough history can help distinguish asthma from COVID-19.<sup>12</sup> In comparison with COVID-19, asthma does not typically present with fevers, loss of taste or smell, or gastrointestinal symptoms.<sup>12</sup> Although no one symptom can be used for differentiation, the presentation should be considered, along with the screening questions to determine whether they exhibit COVID-like symptoms, have had exposure to someone with COVID-19 or have a considerable risk of having contracted the virus.

Once it has been determined the patient is experiencing an asthma exacerbation, there are several standardized tools for risk stratification and assessing symptom control. The Global Initiative for Asthma (GINA) published the *Global strategy for asthma management and prevention*, which clinicians can use to direct management and to assess symptom control and risk factors for poor asthma outcomes.<sup>2</sup> Other standardized questionnaires include the asthma control test and the Asthma Control Questionnaire developed by the American Thoracic Society.

Emergency medical care should be initiated during any part of the encounter if a patient has trouble breathing, chest pain, chest pressure, new confusion, inability to stay awake, or cyanosis. Patients should be transferred to a facility to receive immediate care<sup>11</sup>.

### Risk factors and comorbidities

While most research does not support asthma as a risk factor for a severe disease of COVID-19, many chronic conditions have been associated with worsening outcomes.<sup>7,13</sup> Comorbidities including hypertension, chronic obstructive pulmonary disease, type 1 diabetes, cardiovascular disease (heart failure, coronary artery disease, or cardiomyopathies), obesity, pregnancy, sickle cell disease, smoking, age greater than 65, immunocompromised status, cancer, chronic kidney disease, are risk factors for severe COVID-19 infection.<sup>1</sup> Some studies include the male sex as being at notable risk of developing severe complications.<sup>14,15</sup> Due to limited data, it is unknown whether other underlying medical conditions also increase the risk of severe illness from COVID-19. Adults of any age might also be at an increased risk for severe illness if they have moderate-to-severe asthma, cerebrovascular disease, cystic fibrosis, hypertension, an immunocompromised state, neurologic conditions such as dementia, body mass index greater than 25 but less than 30 kg/m<sup>2</sup>, pulmonary fibrosis, thalassemia or type 1 diabetes. The CDC does not list hypertension as an increased risk factor for severe disease as opposed to other studies.<sup>1</sup> Table 1 summarizes risk factors and symptoms associated with COVID-19.

The WHO lists age greater than 60 years old, diabetes, hypertension, cardiac disease, chronic lung disease, chronic kidney disease, immunosuppression, cancer and smoking as having higher mortality in COVID-19.<sup>30</sup>

Obesity, chronic rhinosinusitis, gastrointestinal reflux disease, exposure to confirmed food allergies, anxiety and depression, are risk factors for poor asthma outcomes.<sup>2</sup> Additional risk factors include smoke exposure, allergen exposure if sensitized and air pollution, which may worsen asthma symptoms. These risk factors and medical adherence should be addressed to decrease

the likelihood of poor asthma outcomes and aid in secondary prevention. Several other factors can also be considered, including major socioeconomic problems, low FEV1 < 60%, sputum or blood eosinophilia, elevated exhaled nitric oxide test (FeNO) in allergic adults and individuals taking inhaled corticosteroids should be assessed, as those are also significant risk factors. Lastly, patients who have ever been intubated or have been in an intensive care unit for asthma, having at least one severe exacerbation in the last 12 months are at higher risk of poor outcomes.<sup>2</sup>

**TABLE 1:**

Comparing symptoms of COVID-19, asthma, influenzas A and B, and the common cold

CONDITION	SYMPTOMS	SPECIAL NOTES
<b>COVID-19</b>	Fevers/chills Cough Fatigue Anorexia Shortness of breath/difficulty breathing Myalgias Sore throat Nasal congestion Headache Diarrhea Nausea Vomiting Loss of taste (ageusia) Loss of smell (anosmia) Persistent	Loss of taste and loss of smell usually occur before respiratory symptoms.  Typically, a person develops symptoms 5 days after being infected; however, symptoms can occur as early as 2 days after infection or as late as 14 days after infection
<b>Asthma</b>	Cough Wheezing Shortness of breath Dry/pruritic skin rash Headache Fatigue	Fever is not typically a symptom of asthma
<b>Influenzas A and B</b>	Fever Cough Sore throat Runny or stuffy nose Muscle or body aches Headaches Fatigue Vomiting Diarrhea	Symptoms usually develop 1–4 days after infection.  Vomiting and diarrhea are more common in children than adults.
<b>Common Cold</b>	Nasal congestion Mucous production Fevers not typical Sneezing Sore throat Runny or stuffy nose Mild to moderate chest discomfort Cough Fatigue	Symptoms have a lot of overlap with influenza symptoms; however, symptom onset is gradual as compared to flu, which is abrupt.  Cold symptoms are generally milder than flu symptoms.

TABLE 2:

Underlying medical conditions at increased risk for severe illness from COVID-19

<b>Risk factors associated with COVID-19</b>	Age > 60 years Type 2 diabetes Hypertension Cardiac disease* Chronic lung disease** Cerebrovascular disease Chronic kidney disease
<b>Conditions that may increase the risk of severe illness from COVID-19 infection</b>	Moderate-to-severe asthma Cerebrovascular disease Cystic fibrosis Hypertension Immunocompromised state Neurological conditions*** Liver disease BMI > 35 kg/m <sup>2</sup> & <30 kg/m <sup>2</sup> Pulmonary fibrosis Thalassemia Type 1 diabetes
<b>Risk factors for poor asthma outcomes</b>	Rhinitis Chronic rhinosinusitis Gastroesophageal reflux disease Obesity Obstructive sleep apnea Depression Anxiety Confirmed food allergies Smoke/ allergen exposure
*Cardiac diseases include heart conditions (eg, coronary artery disease, cardiomyopathies and heart failure)	
**Chronic lung conditions include pulmonary conditions (eg, chronic obstructive pulmonary disease)	
***Neurological conditions include conditions such as dementia	

### Physical examination via telemedicine

In many cases, patients with asthma can have normal physical exam findings if symptoms are controlled. Patients with poorly controlled asthma may have rhonchi or wheezing, which may indicate airflow narrowing or obstruction. If the patient appears cyanotic or uses accessory muscles, this can indicate an acute asthma exacerbation or severe respiratory distress and warrants immediate medical intervention.<sup>31</sup>

It is better to use audiovisual telecommunication methods during the remote assessment instead of audio alone, especially for the physical exam. The provider needs to pay close attention to the patient's general appearance throughout the encounter,

including assessing if they seem breathless or fatigued. Also, pay attention to whether patients are holding onto their chest or using accessory muscles while breathing, as this raises immediate concerns for respiratory distress. Listen to their vocal tone and whether they appear anxious. If a patient has a portable pulse oximetry device, ask the patient to show their readings.<sup>12</sup> Portable spirometry devices are also commercially available and able to be connected to the mobile phone using Bluetooth technology.<sup>32</sup>

### In-person assessment

When performing in-person encounters, it is important to use personal protective equipment, including wearing a gown, gloves, eye protection, face mask, and possibly a respirator when interacting with patients.<sup>15,33</sup> The CDC recommends implementing universal source control measures, as well as executing source control, which includes wearing face masks, cloth masks, or respirators to decrease the spread of respiratory particles.<sup>34</sup> Additional recommendations include encouraging physical distancing of at least 6 feet by arranging seats accordingly and limiting the number of people in the facility. In confined areas, coughing, sneezing or any procedure that increases the presence of transmission (eg, intubations, extubations, bronchoscopy, nebulizer therapy, spirometry, sputum induction and rhinoscopy) significantly increase the risk of transmission. These procedures increase the number of aerosolized particles and are considered high-risk exposures, which should be avoided if possible.<sup>15</sup>

### Imaging and laboratory testing

The CDC recommends testing for COVID-19 for the following people: those who have symptoms of COVID-19, have been in close contact with someone confirmed to have COVID-19 (ie, within 6 feet for a total of 15 minutes or more) or have taken part in high-risk activities, such as traveling or attended a large gathering. If tested, it is recommended to self-quarantine or isolate at home pending test results. For negative tests, it is vital to note that false negatives are possible. The negative laboratory result means patients were unlikely to have been infected when the sample was collected. However, there is always a chance a patient has been exposed since taking the test.<sup>35</sup>

Although no specific tests are recommended for asthma patients who exhibit COVID-19 symptoms, asthma patients had lower levels of ferritin, c-reactive protein and lactate dehydrogenase, which suggests a decreased inflammatory burden in asthmatic patients who are co-infected with COVID-19.<sup>1</sup>

Chest computerized tomography (CT) findings show that patients with COVID-19 infections had bilateral and peripheral ground-glass and consolidative pulmonary opacities.<sup>25,36</sup> The CDC and the American College of Radiology do not recommend using a CT as a screening tool or a first-line test to diagnose COVID-19. CT of the chest should be used sparingly and for symptomatic patients.<sup>37</sup>

### Treatment of acute asthma exacerbation

After observation and evaluation, medical management of an asthma exacerbation should be initiated immediately. Beta-agonists and steroids remain the cornerstone of medical therapy for an acute asthma flare. Patients should be started on a short-

acting beta-agonist (SABA) promptly after initial assessment and corticosteroids should be administered concurrently. SABA medications are preferentially delivered by pressurized meter dose inhalers (pMDI) with a spacer. The pMDIs can be used for up to 10 puffs every 20 minutes. If possible, measure lung function after 1 hour of treatment. Steroids can be administered either orally or intravenously, mainly depending on the severity of the illness. Current dosing guidelines recommend 40–50 mg of prednisolone in an adult patient. Supplemental oxygen is also often used in initial management to maintain a 93%–95% targeted oxygen saturation in adults. If patients are still symptomatic after SABA treatment, inhaled ipratropium bromide can be added to the treatment regimen. For severe exacerbations, arrange transfer to an acute care facility, add ipratropium bromide or consider administering a SABA by nebulizer.<sup>2</sup> It is not recommended to routinely perform chest radiographs, obtain blood gases or prescribe antibiotics for acute asthma exacerbations.<sup>2</sup>

Box 11 of the Pocket Guide for Asthma Management and Prevention provided by GINA summarizes the approach to assessment and management of asthma exacerbations for patients presenting in the primary care setting.<sup>2</sup>

FIGURE 1:

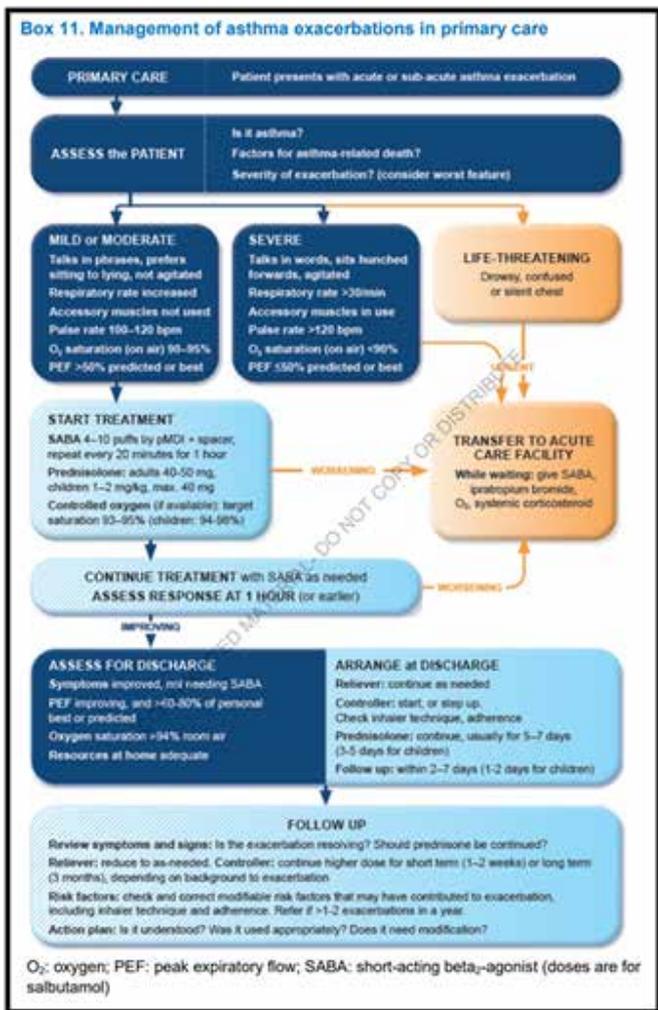
Assessment of symptom control and future risk obtained from the Global Initiative for Asthma *Pocket Guide for Asthma Management and Prevention*

Box 4. Assessment of symptom control and future risk			
A. Assessment of symptom control		Level of asthma symptom control	
In the past 4 weeks, has the patient had:		Well controlled	Partly controlled
Daytime symptoms more than twice/week?	Yes <input type="checkbox"/> No <input type="checkbox"/>	None of these	1–2 of these
Any night waking due to asthma?	Yes <input type="checkbox"/> No <input type="checkbox"/>		
SABA reliever needed more than twice/week?	Yes <input type="checkbox"/> No <input type="checkbox"/>		
Any activity limitation due to asthma?	Yes <input type="checkbox"/> No <input type="checkbox"/>		
<b>B. Risk factors for poor asthma outcomes</b>			
Assess risk factors at diagnosis and periodically, at least every 1–2 years, particularly for patients experiencing exacerbations. Measure FEV <sub>1</sub> at start of treatment, after 3–6 months for personal best lung function, then periodically for ongoing risk assessment.			
Having uncontrolled asthma symptoms is an important risk factor for exacerbations			
Additional potentially modifiable risk factors for exacerbations, even in patients with few asthma symptoms, include:			
<ul style="list-style-type: none"> <li>Medications: ICS not prescribed; poor adherence; incorrect inhaler technique; high SABA use (with increased mortality if &gt;1200-dose canister/month)</li> <li>Comorbidities: obesity; chronic rhinosinusitis; GERD; confirmed food allergy; anxiety; depression; pregnancy</li> <li>Exposures: smoking; allergen exposure if sensitized; air pollution</li> <li>Setting: major socioeconomic problems</li> <li>Lung function: low FEV<sub>1</sub>, especially if &lt;60% predicted, higher reversibility</li> <li>Other tests: sputum/blood eosinophilia; elevated FeNO in allergic adults on ICS</li> </ul>			
Other major independent risk factors for flare-ups (exacerbations) include:			
<ul style="list-style-type: none"> <li>Ever being intubated or in intensive care for asthma, having ≥1 severe exacerbations in the last 12 months.</li> </ul>			
GERD: gastroesophageal reflux disease; FeNO: exhaled nitric oxide; ICS: inhaled corticosteroid; SABA: short-acting β <sub>2</sub> -agonist. See next page for rest of table.			
B. Risk factors for poor asthma outcomes (continued)			
Risk factors for developing fixed airflow limitation include:			
<ul style="list-style-type: none"> <li>Preterm birth, low birth weight, greater infant weight gain</li> <li>Lack of ICS treatment</li> <li>Exposures: tobacco smoke, noxious chemicals, occupational exposures</li> <li>Low FEV<sub>1</sub></li> <li>Chronic mucus hypersecretion</li> <li>Sputum or blood eosinophilia</li> </ul>			
Risk factors for medication side-effects include:			
<ul style="list-style-type: none"> <li>Systemic: frequent OCS, long-term, high dose and/or potent ICS, also taking P450 inhibitors</li> <li>Local: high dose or potent ICS; poor inhaler technique</li> </ul>			
ICS: inhaled corticosteroid; OCS: oral corticosteroid			

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FIGURE 2:

Management of asthma exacerbation in primary care



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### Osteopathic manipulative treatment

Osteopathic manipulative treatment, or OMT, has historically been helpful as an adjunctive method to improve symptoms. There are several mechanisms by which OMT is theorized to benefit asthma management including biomechanical, respiratory/circulatory, neurologic and behavioral mechanisms.<sup>38</sup> Specifically, the biomechanical and respiratory mechanisms of OMT have been shown to enhance mechanical functioning of thoracic cage, balance the autonomic nervous system and improve overall chest wall function.<sup>38</sup> One study performed by Guiney *et al.* showed improved peak expiratory flow rates improved by 22%.<sup>38</sup> However, the authors could not find any specific literature to support using OMT treatment for asthma. Statistical data OMT usage was likely to have decreased during the COVID-19 pandemic.

No specific guidelines have been released regarding treatment recommendations for using OMT in the management of asthma exacerbations. Healthcare providers must carefully judge

whether their symptoms are suggestive of a COVID-19 infection. The American Osteopathic Association and American Academy of Osteopathy have developed an online learning activity that provides clinicians a structure for clinicians to use to improve pulmonary function COVID-19 for patients suspected of having a COVID-19 infection. These techniques are designed to be used to treat COVID-19; however, they could potentially also be used to improve lung function in asthma patients.

### Review response and follow-up

Before discharge, it is imperative to arrange ongoing treatment and follow-up care. For most patients, providers will prescribe regular controller therapy or increase the patient's current dose, to reduce the risk of further exacerbations. Be sure to check the patient's inhaler technique and adherence. It is always helpful to provide an interim written asthma action plan for reference.

Exacerbations often represent failures in chronic asthma care, and they provide opportunities to review the patient's asthma management. A healthcare provider must follow up with all patients regularly until symptoms and lung function return to normal or their previous baseline. Consider referral for specialist advice after hospitalization or patients who repeatedly visit the emergency department for asthma exacerbations.<sup>2</sup>

Follow-up appointments should be arranged within 2–7 days after any exacerbation. At follow-up visits, the physician should review modifiable risk factors, assess the patient's understanding of their medication usage and inhaler technique skills, and revise their written asthma plan, if necessary. Regular review of these measures is both cost-effective and associated with improvement in asthma control and outcomes.<sup>2</sup>

### CONCLUSION

Asthma is a chronic medical condition, which affects a significant portion of the U.S. and world population.<sup>2</sup> An acute asthma exacerbation can be challenging to differentiate from COVID-19 symptoms.<sup>4,5</sup> This has made it difficult for outpatient providers to treat patients, and as a result, there has been a surge in the use of telemedicine.<sup>5,18,26</sup> Due the COVID-19 virus's high transmissibility, it is recommended to screen patients to determine if it is appropriate to be evaluated in person or via telemedicine.<sup>18–20,30</sup> Next, it is essential to assess symptoms, assess risk factors, obtain a history and perform a physical exam. Depending on your clinical suspicion, if an acute asthma exacerbation is suspected, immediately begin treatment. It is important to recognize life-threatening symptoms and transport them to an emergency care facility immediately if they should occur. Asthma treatment requires a multifaceted approach aimed toward symptom control, risk factor modification, development of action plan and treatment. Follow-up with patients and revisit asthma management even if symptoms are well controlled for long-term effectiveness.<sup>2</sup> While treating patients' acute symptoms, it is vital to recognize triggers and modifiable risk factors such as smoking. Although there are osteopathic manipulative techniques for asthma, there are no specific guidelines released regarding treatment recommendations.

**DISCLOSURES AND FUNDING:** The authors received no financial support related to this submission and have no financial affiliations or conflict of interest related to this article to disclose.

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