



Using Telemedicine to Care for the Asthma Patient

Yudy K. Persaud¹

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Abstract

Purpose of Review To review the data supporting the use of telemedicine (TM) and to provide practical guidance for practitioners to optimize the care of their asthmatic patients.

Recent Findings Previous to the pandemic, TM was little used in various aspects of asthma care. Since the pandemic, TM has been increasingly used in new ways to care for asthma patients at various locations. In addition to direct-to-consumer visits for asthma care, other forms of telehealth visits have been increasing such as facilitated visits, asynchronous, remote patient monitoring, e-consults, and mHealth. Moreover, patient and provider satisfaction with the use of TM has been increasing and is comparable at times with face-to-face visits. In this review, best practices for starting a telemedicine asthma service with patients at home, distant clinic sites, and various other locations, including school-based asthma programs, are reviewed.

Summary TM is a valuable adjunct to face-to-face visits for asthma care. Following the recommended best practices can strengthen the implementation of a telemedicine asthma program (TMAP) into clinical practice. Providers must be vigilant in keeping current with the various nuances required for asthma telemedicine care in preparation for the post-pandemic environment.

Keywords Telemedicine asthma program · Facilitated virtual visit · Asynchronous · Remote patient monitoring · mHealth

Introduction

Telemedicine

Prior to the COVID-19 pandemic, practitioners have used telemedicine to address access to care issues and to complement medical care. However, the healthcare system saw fundamental changes in healthcare where visits needed to be conducted virtually or, in some cases, a hybrid model was used. During this time, providers and patients used telemedicine out of necessity, and in many instances, as the only option to take care of asthma patients. Visits were performed from a distance to protect the health and welfare of the patient and provider. Now, healthcare systems and private practitioners are working on a contingency plan, post-pandemic, which might incorporate telemedicine options as a standard of care.

Telemedicine can be performed in different ways depending on the rationale for its use. Live or synchronous TM visits used for asthma care include direct-to-consumer (DTC) and facilitated virtual visits (FVVs). If a visit does not need to be live, then it can be done asynchronously. These include remote patient monitoring (RPM), e-consults, and the use of mobile health (mHealth) applications. As mentioned in a recent editorial, the type of telemedicine platform used should be based on the goal the provider is trying to achieve in asthma care [1••]. Thus, DTC, FVVs, RPM, communication via patient portals, mHealth, and the use of e-consults can be used in various aspects of care.

Asthma is a multifaceted disease with a range of severities. It affects over 25 million Americans of which 5 million are children under the age of 18 [2]. It has a tremendous impact on healthcare cost, lost work/school days, and mortality [3]. Although many would like to think that traditional care will go back to “normal,” it is likely that we are at a turning point in healthcare. The traditional asthma care has always involved an in-office visit but new innovative ways to care for our patients efficiently and effectively are desperately needed. Although the pandemic severely limited access to healthcare, telemedicine was instrumental in

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✉ Yudy K. Persaud
ypersaud@bronxcare.org

¹ Division of Allergy, BronxCare Hospital Systems, Bronx, NY, USA

enabling providers to continue to care for their patients. This was during a time when patients were not physically able to go to the office. However, providers learned quickly how to care for these patients and some will continue to use a hybrid model in the future. Regardless, the asthma specialist must be prepared for the long haul and for the eventuality of another pandemic.

For this review, we will include research findings on past and current uses of telemedicine for asthma care. Unfortunately, during the current pandemic, the use of telemedicine was based on necessity. The primary reason for its use was not evidence-based regarding outcomes, satisfaction, return on investment, etc. We will delve into the different types of telemedicine platforms used, concerns about provider/patient satisfaction, school-based telehealth services, and the most important question of whether it is as effective as in-person care. Expert opinion will be given on the future use of telemedicine as well as emerging technologies that will be used in taking care of various types of visits for the asthmatic patient. Such visits can be divided into live (or

synchronous) which can be used for such care as direct-to-consumer (DTC) and facilitated virtual visits (FVVs). Asynchronous methods would include remote patient monitoring (RPM), mobile health (mHealth) applications, and the use of e-consults (look at Fig. 1).

Starting a Telemedicine Asthma Care Program

When starting a telemedicine asthma program, one should follow a template to ensure success. The following 10 steps were recently published and should be used when starting a telemedicine asthma program [1••]:

1. Understand the different types of telemedicine and use the appropriate types to treat your patients with asthma
2. Stay up to date with state and federal telemedicine laws
3. Pick a platform
4. Build the infrastructure
5. Offer your patients the telemedicine appointments
6. Get informed consent

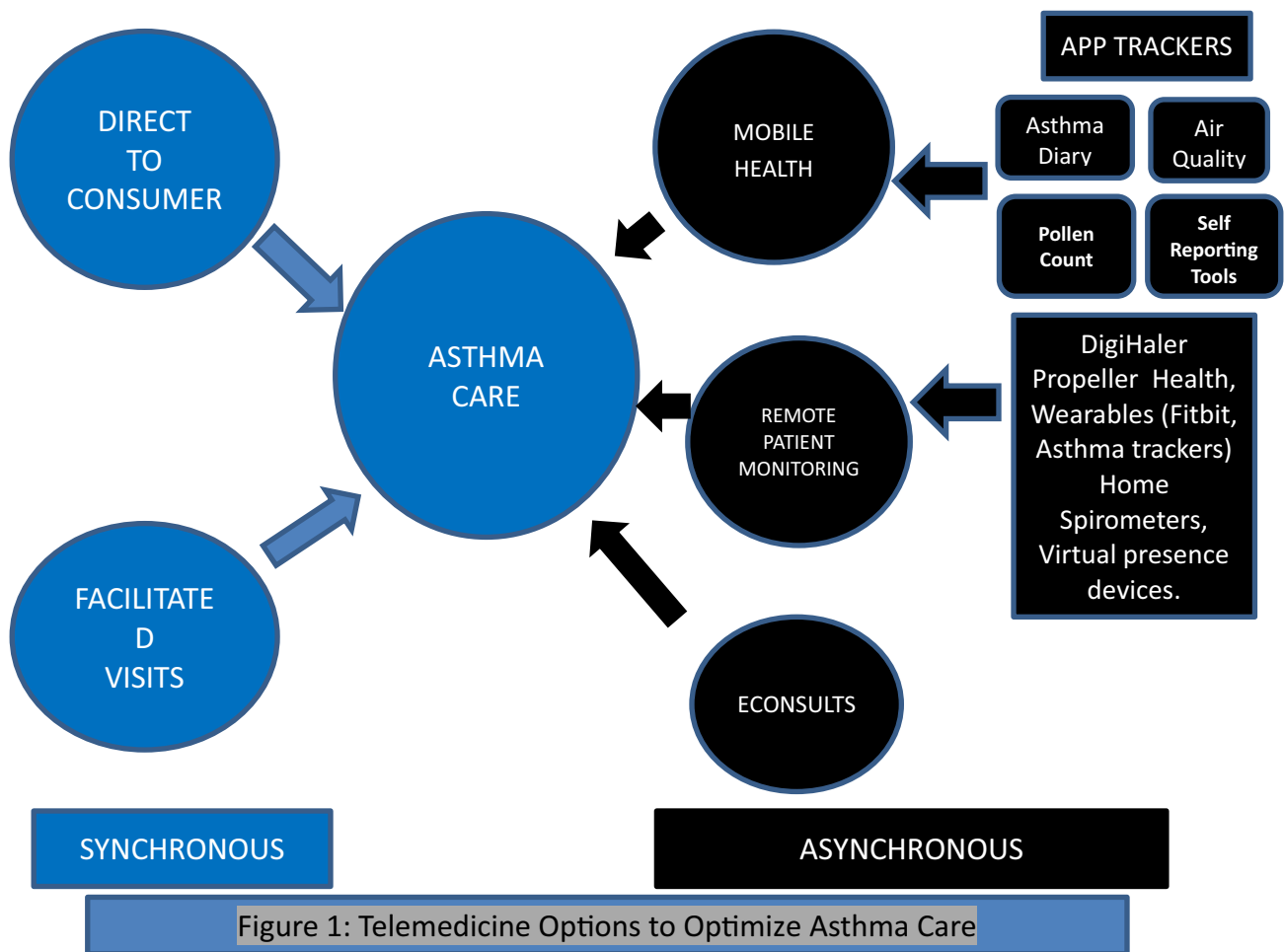


Fig. 1 Telemedicine options to optimize asthma care

7. Prepare for the visit in advance
8. Perform the visit with your patient
9. Perform a virtual examination
10. Bill for the encounter

Selection of a Telemedicine Platform

Historically, a telemedicine platform was any virtual technology that was able to connect the provider and patient. Subsequently, numerous platforms were created that included an all-inclusive option for the different types of telemedicine visits. For asthma care, platforms have different options to allow the visit to be performed (Table 1). In facilitated visits with a telepresenter, the originating site where the patient is located can use various digital tools to transmit live data to the provider. Selecting a telemedicine type will be based on the availability of the provider and the preference of the patient. It should provide various levels of care for asthmatic patients. Broadly speaking, this can be divided into synchronous (or live) and asynchronous visits. The synchronous visit can be carried

out via a direct-to-consumer (DTC) or a facilitated virtual visit (FVV) while remote patient monitoring (RPM), e-consults, and mHealth visit can be done asynchronously.

During the PHE, the federal government allowed for the use of various platforms and technology which were needed during the COVID pandemic. Most providers have tried more than one platform each having their own distinct advantages. Currently, most have chosen at least one that they are most comfortable with. Although during the waiver these platforms did not need to be HIPAA-compliant, we can now expect that they will have to be HIPAA-compliant. The fundamental HIPPA rules stress that identifiable health information has to be encrypted. Some HIPAA-compliant vendors include AMD, AmericanWell, Zoom for HealthCare, Doxy.me, Teladoc, and GoToMeeting [4]. Other nonencrypted popular telemedicine platforms currently being used include FaceTime, WhatsApp, Skype, and Zoom (free version) [4].

Some features of the platforms that were necessary for a telehealth visit were reviewed by the American College of Allergy & Asthma (ACAAI) to update practicing allergists on

Table 1 Source: J Allergy Clin Immunol Pract. 2021 Jan;9(1):13–21

Feature of platform	Description	Used for which type of TM
2-way video	Patient and provider can see and hear each other in real time	Synchronous DTC and facilitated visit
Multipresence	More than 1 provider and/or patient can participate at a time. Translator can be incorporated in visit	When parents/guardians are at a different location than their child To invite a consultant to participate Interprofessional consultations
Mobile apps vs. cloud-based option	Can permit patients and providers to participate in video conferencing using a smartphone or tablet when a computer is not available -Via cloud-based no download of an app is necessary and can be accessed via any browser -Apps permit tracking of biomarkers	Synchronous DTC and facilitated visit Remote patient monitoring and mHealth for tracking patient-generated information on possible triggers, etc
Screen sharing	Permits providers to show information to patients including test results and instructions Permits patients to show information such as pictures and symptom charts	Synchronous DTC and facilitated visits
Digital exam transmission	Permits output from digital exam equipment to be viewed by a provider (i.e., pulmonary function testing, vital signs, lung sounds, etc.)	Facilitated visits DTC if the patient has exam equipment Sore & forward RPM mHealth
Integrated environment	Tier 1: FPF (fetch/push/file) EHR-to-EMR integration Tier 2: Advanced (discrete fields) EHR-to-EMR integration Tier 3: Embedded video engine EMR integration (ideal)*** ***Permits scheduling of appointments, billing, and other administrative tasks	Synchronous DTC and facilitated visits
HIPAA-compliant	Transmits information to and from provider in a secure manner consistent with HIPAA regulations	Any TM activity should be HIPAA-compliant

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current platforms available during that time. The task force evaluated eight criteria for each platform based on IT support, provider experience, patient experience, workflow, HIPAA compliance, technical requirements, features, and costs [5]. Since then, many new platforms have been updated and new ones have been formed. Providers need to keep in mind that these platforms have variable features for rendering care that depends on the requirement of the individualized visit.

Face-to-Face Telehealth Patient Visits

Direct to Consumer

DTC was the most popular form of telemedicine option pre-pandemic and continues to be used. This has now become the most commonly used type of TM [6]. This involves the patient being located in their residence, school, workplace, or other locations. The provider can be located at a distant site such as the hospital, office, home, or a convenient area conducive to performing an adequate TM visit. Places that might be harmful to conduct a TM visit (i.e., while driving, etc.) or where there is a lack of privacy are strongly discouraged.

For the asthmatic patient, home monitoring is an advantage gained by a virtual visit. Here, the provider will be able to evaluate for possible triggers in the residence of the asthmatic patient. They can also give suggestions based on what is seen during the visit. For example, avoidance of smoke exposure, mold, pets, and other allergic triggers can be discussed based on what can be seen or discussed. With a multiple screen capability, more than one home or even school environment can be placed on the screen at once. This would occur when the parent/caretaker and child are at different locations. Furthermore, the provider can perform a virtual physical examination as well as review findings from home monitoring devices. Some home devices include a digital scale, thermometer, blood pressure devices, pulse oximeter, peak flow meters, and spirometers.

DTC can also have limitations for patients and providers that do not have internet access with good bandwidth, antiquated equipment, and lack of support staff. Practices need to invest in the proper infrastructure and training of the providers/patients to perform these visits seamlessly. A lack of an adequate implementation or “roll out” process might lead to a failed telehealth program. Thus, periodic review to ensure that the program is providing a clinically appropriate, safe, and adequate care within a legal framework is necessary.

Facilitated Virtual Visit

Facilitated virtual visits have become popular in areas where patients do not have the infrastructure to perform a virtual visit. Most clinical sites will have the equipment to perform

the virtual visit with the provider at a distant site and are coordinated using a telepresenter. A telepresenter is a trained facilitator of devices that may help the provider enhance their care of the asthma patient. They may be trained to do standardized questionnaires (i.e., ACT) and procedures (i.e., PFT) prior to the provider entering the virtual visit. They are also trained on connecting stethoscopes so that the provider can hear the lung sounds clearly. Objective measures generated from a pulmonary function test (PFT) can be performed and read by the provider in a synchronous fashion. If the provider is not available for a live visit then the PFT can be stored and forwarded to the provider to be read asynchronously. The digital stethoscope can be used to listen to lung sounds or can also be recorded so that the provider can listen at a later time as well. Usually, this site will also have a sphygmomanometer, thermometer, pulse oximeter, PFT's, etc. to perform the telemedicine visit.

One study done with children by Portnoy et al. [7••] used digital presence equipment (i.e., digital stethoscope, otoscope, high-resolution camera, and spirometry) to compare with an in-person visit for asthma over a 6-month period. They were able to show no difference in Asthma Control Test (ACT) or family satisfaction scores when compared to an in-person visit [7••]. Another study done by van den Wijngaart et al. [8], using a virtual asthma clinic, also demonstrated even better ACT and symptom-free days when compared to an in-person care. Furthermore, the authors were able to prove that virtual care was effective in reducing healthcare costs in the Netherlands [9]. Brown and Odenthal [10] were able to successfully use a community pharmacy as an originating site for a facilitated visit. During this study, the pharmacy staff was used as a telepresenter. They were able to collect spirometry results, ACT scores, informed consent, etc. prior to connecting with an asthma educator. The asthma educator then connected with the PCP, and asthma specialist to enhance access to care [10].

Although the major advantage of doing a FVV is the ability for the provider to perform a physical exam at a distant site, there can be a few downsides. For example, the virtual visit must be discussed beforehand between the provider and patient and might still not be deemed appropriate. Also, a patient's travel to the site might prove burdensome or inaccessible. Furthermore, some practitioners require that the initial visit be in-person with a follow-up via DTC or FVV. It is this author's opinion that with new and innovative ways of a virtual examination, an in-person initial visit might not always be required.

Remote Patient Monitoring, mHealth, and Emerging Technologies

Traditionally, remote patient monitoring (RPM) has been widely used in chronic conditions (i.e., diabetes,

hypertension, congestive heart failure) and has shown similar outcomes to in-person visits [11]. With recent technological advancements and the need to monitor other chronic conditions, it can now be used in asthma management as well. Providers have always relied on the history of the asthmatic patient or guardian regarding the patient's asthma symptoms and the home usage of their medications. However, emerging technologies such as home monitoring devices, apps, text messages, emails, and web-based applications are increasingly being used to improve asthma care [12•]. By remotely monitoring patients asynchronously, information can be electronically transmitted to a provider. This has made it easier to closely track adherence as well as receive objective measures when patients are at sites away from the office setting. Typically, a digital platform will have a patient app and clinician dashboard to continuously monitor asthma adherence and various pulmonary parameters.

Previously, it was questioned if such apps were effective in asthma care since there are no official criteria on its evaluation, lack of FDA regulation, and their lack of effectiveness in monitoring childhood asthma. Furthermore, they are usually created without guidance from medical experts [13–18]. However, mobile apps continue to be used in various aspects of asthma care to remotely monitor patients and in the self-monitoring of patients' asthma symptoms. It can also provide information on asthma-related triggers, such as indoor or outdoor air quality. Information can even be used by the patient, provider, and medical facility to look at variables that might help in providing timely feedback to manage asthmatics and evidently to help in the adherence of asthma medications [19–23]. Some apps have been successful in improving different asthma outcomes such as ACT scores, decreased use of corticosteroids, and even improving lung function [17, 23–27].

Inhalers with sensors have been useful in monitoring patients' usage of their asthma medications [20, 21, 28–31]. A review by Nguyen and colleagues [32] reviewed over 400 asthma-based apps and found 6 that specifically used a sensor (4 Propeller Health systems, 2 BreatheSmart by Cohero health) on an inhaler to track patients usage. Another device being used include the Digihaler (TEVA pharmaceutical) which includes SABA, ICS, and ICS/LABA (AirDuo® Digihaler® ArmonAir® Digihaler® respectively) which has a built-in sensor that also detects adherence to medications. Furthermore, it has the unique ability to measure the inspiratory flow rate (L/min) of the patient. This can help to decipher if the patients are taking acceptable breaths with their medications [33]. Other popular apps being used include Kiss my asthma (KmAsthma), Asthma MD, AsthmaXcel, Asthma Australia, Ask Me, AsthMe!, and MASK-air [18, 34, 35]. Two recent reviews looking at various digital technologies showed that it can be implemented in asthma care. Doshi and colleagues [36] reviewed 14 studies on the effect

of various technology-based interventions (i.e., pictures, videos, games, etc.) on patient-reported outcomes (PROs). They showed that medication self-efficacy was the most significantly improved PRO while asthma severity was not changed [36]. However, the review did not show a significant change in ED visits and hospitalizations. Mosnaim and colleagues [37••] showed that the best digital technologies that showed improvements in asthma adherence and impairments were those that were two ways and interactive. However, neither review showed a significant improvement in asthma burden or patient outcomes indicating that more innovative research is needed.

One common myth with TM is that there is a lack of objective findings in the home compared to an in-office visit. However, with RPM devices, providers can attain digital peak flow meter readings, inspiratory flow volume, pulse oximetry, and even spirometry readings such as FEV1 [33, 38, 39, 40•]. One study comparing home spirometry showed that in children with asthma and CF, home FEV1 measurements with a portable home spirometer were significantly lower than the FEV1 measurement by a pneumotachometer in the hospital [40•]. This might represent a more accurate real-life setting in the home than a controlled office setting. Another study showed similar rates of interpreting a remote spirometry with an in-person spirometry in a rural setting [41]. Furthermore, the field of artificial intelligence (AI) is increasingly being used for asthma and other respiratory diseases [42]. A study done by Topalovic showed that AI was superior compared to pulmonologists in interpreting spirometry and correlating them with a correct diagnosis of asthma vs pulmonologist ($p < 0.0001$) [43]. How artificial intelligence and machine learning will complement clinical care brings much hope for the future.

E-Consultation/Interprofessional Consultations

E-consult occurs when a provider connects asynchronously with a specialist for a consultation. Usually, these are used to answer a clear question of low acuity in the care of a patient. The popularity has risen due to a lack of asthma specialists and a prolonged waiting time to see such specialists. Here, the primary care provider writes a directed question and the specialist will review and give feedback, usually within 72 h. It can be used to reduce unnecessary referrals while, at the same time, enhancing the relationship between the specialist and the provider. Furthermore, e-consults can be used to increase a physician's knowledge about asthma guidelines, how to evaluate different asthma phenotypes, and treatment options. In the end, it will save the patient time in the management of their asthma and reduce unnecessary healthcare utilization.

Billing for e-consults and interprofessional consultation can be done based on the type of the visit. E-consult

codes include 99,451/99452 and are used by a consultative physician who provides a written report to the patient’s treating/requesting physician. Interprofessional electronic consultation codes 99,446, 99,447, 99,448, and 99,449 are used when the consultants provide written reports and verbalize their recommendation to the referral provider or other qualified health personnel involved in the care of the patient. One exception is that these codes are only allowed to be billed once within a 7-day interval, but you may combine the time if two or more reports are needed within this timeframe. Another exception is that the specialty visit cannot occur 14 days before or after the consultation.

Ideally, interprofessional consultations can be used very effectively to connect the asthma specialist and primary care providers in a community setting. However, it can be used for other professionals involved in the care of asthmatics as well (i.e., community pharmacies, asthma educators, emergency rooms, school nurses, etc.) In fact, pharmacists should be heavily involved since many patients rely on them for their asthma medications more than the medical follow-up visit [44].

Although e-consults will limit the amount of low complexity consults for a specialist, it can be used in a specialist-centric model to increase the asthma specialist area of referral (Fig. 2). In essence, this model can be used as a marketing tool to strengthen community relationships, which essentially will increase the number of referrals for the specialist.

School-Based Asthma Telehealth Programs

The school setting has been used increasingly as another originating site for telehealth encounters. Some research studies have shown the benefits of implementing school-based telehealth programs [45–49]. In a study done by Halterman et al. [45], children in an interventional group were directly observed for use of preventative medication therapy and given telemedicine visits. This led to more symptom-free days and less acute healthcare use than traditional in-person visits with a primary care physician [45]. In a study done by Perry et al. [46], a synchronous visit was complemented with asynchronous spirometry results. When compared with an in-person visit with a provider,

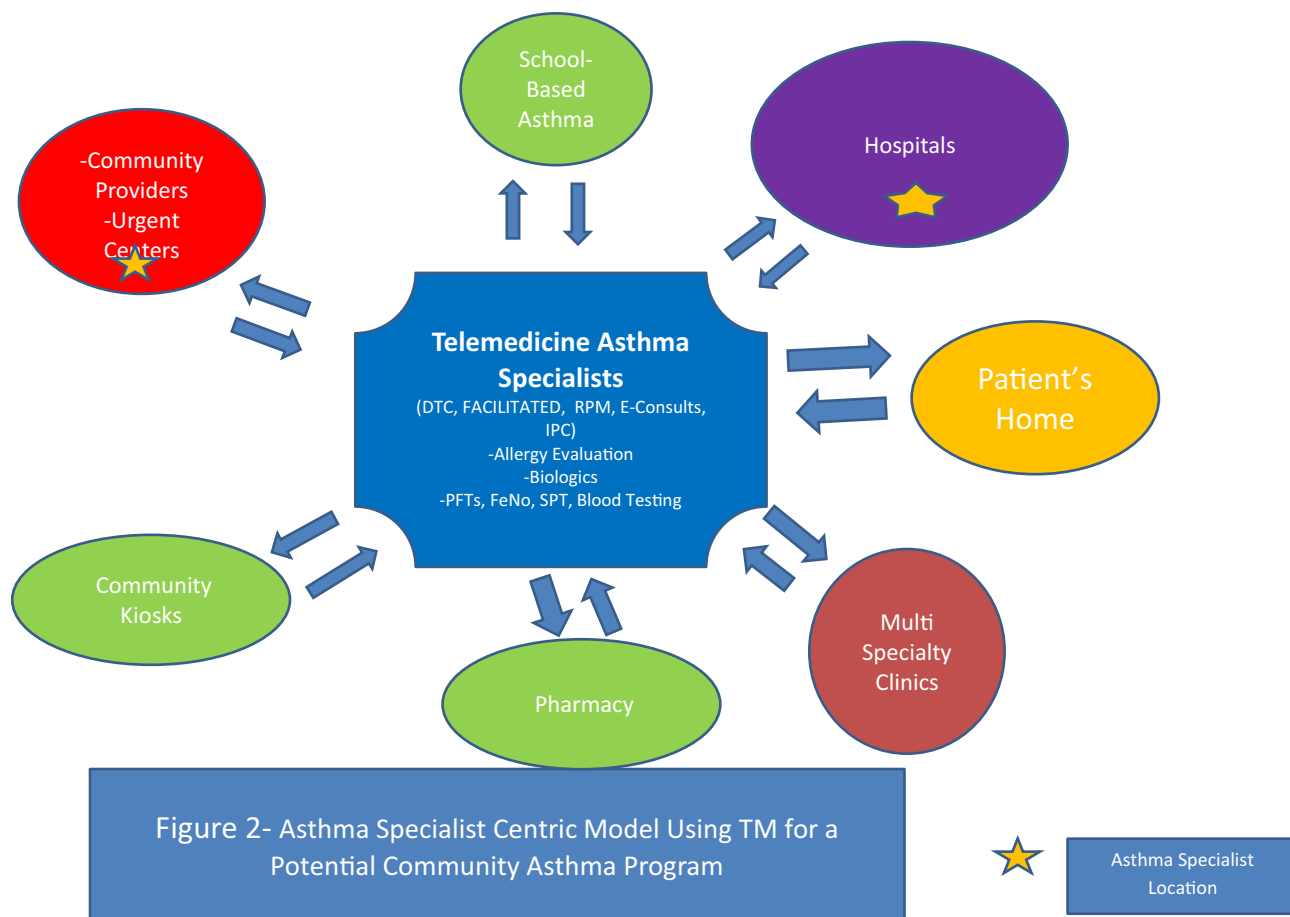


Fig. 2 Asthma specialist–centric model using TM for a potential community asthma program. Yellow star: asthma specialist location

the study showed no statistical difference in symptom-free days, quality of life, or spirometry findings [46]. Some programs involved using an initial face-to-face visit with a specialist and then remotely doing a virtual visit with a nurse [48]. Others used the school nurse as a telepresenter to help perform synchronous visits with an asthma specialist Bergman et al. [47]. Another study by Bian et al. [49] was able to offer telemedicine to children with asthma exacerbation to providers and was able to decrease emergency room visits. As providers become more comfortable in using telehealth, we should see every school with high asthma rates using telehealth as a tool to improve the health of these students.

Using the asthma specialist–centric model (Fig. 2), each point of care will be an important component for a community asthma telehealth program. The different points of care need to be properly incorporated in performing DTC and possible FVVs. Healthcare systems, health plans, providers, community organizations, etc. should collaborate and provide the necessary support to ensure the success of the program. Ideally, it must be a seamless system that will not put added strain at the different points of care that already have high demands, such as school-based clinics.

Patient/Provider Satisfaction

During the pandemic, we saw initial frustration using telemedicine as well as its eventual acceptance. Overall, if done appropriately, studies are showing that providers and patients can be quite satisfied with virtual visits [50, 51]. As platforms become easier to use and providers can work out the intricacies in the technology so will satisfaction continue to improve. The convenience of telemedicine cannot be overstated as many do not want to return to the “traditional” ways of patient encounters. Telemedicine usage will continue to climb as long as providers, patients, and administrators are satisfied with it [52]. Many patients have a positive outlook on the use of telemedicine for asthma care [51, 53, 54]. In a study done by Portnoy and colleague [55], 37% of allergy patients were more satisfied with a telehealth visit when compared to an in-person appointment and no patient was less satisfied. In another study done by Lanier and colleagues [53] in which the major diagnosis was asthma, patients felt comfortable with their telehealth visit and 40% rated it as equivalent or superior to an in-person visit. However, in this study, there were a disproportionately significant number of white patients who were more comfortable with these visits compared to Hispanic patients [53]. Thus, more research is needed to evaluate the different populations to see how they may benefit from telemedicine.

Conclusion

One of the biggest myths that came out of the “telemedicine era” is that telemedicine is just simply about technology. Telemedicine is a wonderful tool that will enable the provider to care for their patients in efficacious and innovative ways. This is especially true when we provide care to our asthmatic patients.

Since the popularity of telemedicine during the pandemic, the results of many studies are currently in press and results are coming. We need prospective studies with statistical power before guidelines can be issued on the use of telemedicine etc. For instance, although there are many apps available for asthma care, they are not backed by FDA standards and lack randomized control studies that measure asthma outcomes. More research is needed to compare telemedicine vs in-person asthma care. Strict guidelines are needed to determine when telemedicine visits are inappropriate for asthma care.

Telemedicine has allowed improved access to specialist care via telemedicine. In lower socioeconomic areas, which tend to have a lack of asthma specialty care, a solution can be telemedicine. For instance, an allergist can now be accessible to different areas of a community to provide enhanced asthma care such as spirometry, skin testing, and biologic use.

Telemedicine will continue to revolutionize the way asthma care is rendered. Barriers such as access to technology/internet, lack of digital literacy, cyber risks, and parity reimbursements will continue to exist. If such barriers can be adequately addressed, it is then quite possible that a telehealth visit might be the preferred avenue of care for many patients. One major barrier has been reimbursement. But now, many services of telehealth are reimbursable and this has been incorporated into practices as a hybrid model. However, expect that health insurers will limit some aspects of telemedicine to prevent the frivolous use of telemedicine or those visits that are deemed incomplete. Proper documentation is essential for the proper integrity and continuity of care of asthma patients. Documentation on length of time of the visit, name of platform used, informed consent, virtual examination, and vital signs is essential [1••].

Telemedicine can be used to specifically address the disparity of asthma care given to patients when done in an innovative way. We have seen this being done in one part of the South Bronx, which is the poorest congressional district in the USA and considered by many to be the “asthma capital of the world.” Specialty care can be connected in such a community via telemedicine if done appropriately. Here, the allergist can supervise a community where specialty asthma care is desperately needed (Fig. 2). Using telemedicine to connect specialists with various points of care in a

community for chronic medical conditions such as asthma will be the future of healthcare (Fig. 2). Furthermore, personalized medicine conducted in the home environment will be where most medical education and care will be done in the future, instead of the traditional office setting.

Declarations

Conflict of Interest Yudy K. Persaud has received an honorarium for serving on the advisory board and speaker's bureau for GlaxoSmith-Kline and has also participated in research with Astra Zeneca and TEVA that are not relevant to this article.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- Of major importance

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