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Challenges for asthma units in response to COVID-19: a qualitative group dynamics analysis

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Abstract

Objective: To develop a set of recommendations for the management of severe asthma during COVID-19 pandemic.

Methods: Eleven pneumologists and allergologists who were staff members of officially accredited asthma units in Catalonia (Spain) participated in a cross-section study based on three 2-hour virtual workshops (first: brainstorming, second: identification of impacts and challenges summarized in 10 topics, third: establishment of final recommendations by consensus).

Results: Impacts and challenges identified were improvement of referral protocols between different levels of care; assessment of the minimum number of function tests to be performed and promote the performance of spirometry in primary care; implementation of videoconferencing, mobile apps, telephone calls, or integral virtual platforms for the follow-up of patients, and definition of the model of care (face-to-face, telematics, mixed) according to the patient's individual needs; self-administration of biologics for domiciliary treatment; and empowerment of the role of nursing and hospital pharmacy in particular for follow-up and self-administration of biologics. The main recommendations included coordination between primary care and specialized care consultation, optimization of lung function testing, implementation of telemedicine, and the role of nursing and hospital pharmacy.

Conclusion: The specific proposals in response to the effect of COVID-19 pandemic focused on four areas of interest (coordination between primary care and specialized care, optimization of lung function testing, implementation of telemedicine, and empowerment of the role of nursing and hospital pharmacy) may be generalized to other health care settings, and help to introduce new ways of caring asthma patients in the COVID-19 context.

Keywords severe asthma; asthma units; COVID-19; asthma management; recommendations; consensus; telemedicine

Introduction

Asthma is a highly prevalent disease worldwide, with around 300 million people living with asthma and affecting 1–18% of the population in different countries (1). The high economic impact of asthma is largely attributed to severe asthma (2). Uncontrolled severe persistent asthma accounts for 3.9% of all asthma diagnoses (3). The current pandemic with the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that causes coronavirus disease 2019 (COVID-19) is spreading globally. As of January 1, 2021, 81 658 440 confirmed cases have been reported with 1,802 206 deaths (4). In Spain, 38.4% of patients with confirmed COVID-19 acquired between March and June, 2020, during the first wave of COVID-19 pandemic required hospitalization (5). In a matter of months, the COVID-19 pandemic has escalated into an unprecedented public health as well as an economic crisis, and has strained health care systems and disrupted or halted health services around the world.

Severity of COVID-19 infection has been associated with some underlying comorbidities, such as hypertension, diabetes mellitus, cardiovascular disease, and respiratory system disease (6). Although it seems that pre-existing asthma has a potential influence on SARS-CoV-2 susceptibility and disease course, existing studies have not indicated a high prevalence of asthma

among COVID-19 patients (7). Based on data from different cohorts, it does not appear to be an increased risk for people with asthma to acquire COVID-19 infection or to have more severe presentation of the disease (8, 9). According to the high prevalence of asthma, it has been hypothesized that patients with asthma may be protected from COVID-19 due to the pathophysiology of the disease, including the role of accumulation of eosinophils, the type 2 immune response with Th2 cells, or downregulation of the angiotensin-converting enzyme-2 (ACE2), the receptor responsible for the uptake of SARS-CoV-2 (6). Drugs used for asthma treatment may also play a protective role, inhaled corticosteroids decrease pro-inflammatory cytokines and increase anti-inflammatory cytokines, such as IL-10 secretion, or the anti-IgE antibody omalizumab has shown to enhance anti-viral immunity via a downregulation of the high-affinity IgE receptor on dendritic cells with increased expression of tumor necrosis factor-alpha (TNF α) (7, 10). However, in the face of unprecedented times of SARS-CoV-2 virus infection, there remains much to be learned about the management of patients with asthma, although the most recently updated clinical guidelines basically recommend that the established treatment for asthma should be maintained (11–13). Also, the COVID-19 has raised questions about efficient ways to access for consultation and diagnostic tests, or whether biologics for severe asthma may be used differently in the COVID-19 pandemic era. In this respect, the experience of some centers in getting across the COVID-19 pandemic have shown the advantages of creating COVID-19-free zones or recommending self-administration of biologics at home (14).

Thus, in the presence of tangible problems caused by COVID-19 pandemic, the management of patients with asthma should be addressed with the greatest possible consensus among health care specialists especially among those who are experts in asthma. The assessment and management of patients with severe difficult-to-control asthma in specialized asthma units aims to improve the quality of care and control of the disease. In order to provide a homogeneous and high-quality care for asthma patients, particularly those with severe asthma, the Spanish Society of Pneumology and Thoracic Surgery (SEPAR) had established the necessary requirements for the provision of official accreditation standards of asthma units. Briefly, asthma units have been accredited based on health care activity, technical and human resources, training programs in asthma, and research and representative activities (15).

In the framework of accredited asthma units and the level of expertise of their staff physicians, a study was designed to identify the main areas of current interest and to establish recommendations for overcoming challenges of managing asthma patients in the context of COVID-19 pandemic.

Methods

Design and participants

Between June and September, 2020, a cross-sectional study based on a group dynamics approach through virtual workshops was designed. The objectives of the study were the following: 1) to assess the main problems and current challenges associated with the care of asthma patients during COVID-19 pandemics, and 2) to develop a set of recommendations for the management of severe asthma in daily practice.

A total of 11 pneumologists and allergologists who were staff physicians of one of the eight accredited asthma units of tertiary care hospitals located in Catalonia (Spain) participated in the study. Catalonia is an autonomous community on the northeastern part of Spain (official 2020 population, 7,727 029 inhabitants). All participating asthma units had received official accreditation by the SEPAR (two of them had been also accredited by the Spanish Society of Allergy and

Clinical Immunology) (16) and belong to the Catalan public health system that provides universal free coverage and a comprehensive portfolio of services.

Study procedure and workshops

The study procedure was based on a participative methodology with the adoption of the lean management perspective coming from the industrial sectors. Lean thinking analyzes processes to improve the efficiency and effectiveness of systems by driving out waste (non-value steps) and has been used in the healthcare (17, 18). In the present study, all participants on the basis of their experience developed a “conceptual phase” with reflection and discussion of the role and organization of asthma units in the context of COVID-19 pandemic. This was followed by an “applied phase” in which they agreed on measures to be implemented for improvement focusing on the resources and strategies that create value, putting the patient in the foreground including definitions of the actions to be implemented, improvement of care, and feasibility of the changes proposed as key performances of the processes.

Three 2-h online sessions were planned, each one during the first two weeks of June, July, and September 2020, without a fixed calendar and on the most convenient days of the week for all participants. One of the authors (C.M.R.) coordinated the sessions. The same 11 healthcare professionals participated in all three sessions. The virtual workshops were performed using the Microsoft Teams platform in which the participating physicians analyzed, discussed, and evaluated different current and future aspects related to the effect of COVID-19 pandemic on daily activities of asthma units, mainly focused on the care of patients with severe asthma. Questions and aggregated responses from every participant regarding the impact and challenges in the face of the COVID-19 pandemic were obtained by means of the Mentimeter interactive presentation platform (www.mentimeter.com).

Logistic support for the workshops methodology was provided by Deloitte consulting (Barcelona, Spain), which included assistance to participants for the strategic reflexion of the situation generated by the health crisis through the dynamization of virtual work sessions, identification and selection of COVID-19-related impacts and challenges for asthma units, prioritization and summary of impacts and challenges, and collaboration in the definition of final recommendations applicable to the asthma units.

The first workshop was a brainstorming in which participants reported their personal experience and on the basis of interactive questions and responses, the key dimensions regarding impact of COVID-19 pandemic and challenges to overcome were identified. Main contents included a variety of aspects, such as the general impact on health care organization at the level of patients, professionals, processes, accessibility, etc.; changes implemented to adapt to the situation including patient management, current situation of the patients in asthma consultations (accessibility, patients' profiles, provision and management of diagnostic tests and lung function testing, etc.); definition of the main challenges posed by COVID-19 pandemic to programmed and urgent activities of asthma units, including how to resume halted patient's care, reorganization of units, role of telemedicine, virtual and face-to-face models of care, management of spaces and resources, segmentation of patients to define health care models, performance and rationalization of lung function tests, and management of asthma in a setting of regrowth phases.

In the second workshop, impacts and challenges identified were discussed and finally aggregated and summarized into 10 topics each. Then, each participant distributed 100 points to individual topics according to the degree of importance considered for his/her particular asthma unit, and those with the highest scores were selected. All votes were anonymized because this is one functioning characteristic of the Mentimeter interactive presentation platform. In the third workshop,

participants were aware of the results obtained in the previous session and after discussion, a set of recommendations were established by consensus. The structure of events is summarized in Figure 1.

Results

Impact of COVID-19 pandemic

The impacts of COVID-19 pandemic on health care professionals, patients, and processes in the asthma units identified in the first virtual workshop with the brainstorming technique are shown in Tables 1S to 3S (Appendix 1, Appendix 2, Appendix 3, Supplementary material). The 10 topics that achieved the highest scores regarding the impact of COVID-19 in asthma units are summarized in Table 1, and included a number of aspects related to the workforce and consultations, role of nursing/hospital pharmacy, telemedicine, stress and emotional impacts, diagnostic tests, treatment at home, team feeling, clinical protocols, uncertainties/difficulties, and patients' response.

Challenges posed by the COVID-19 pandemic

Challenges identified by participants during brainstorming in the first workshop are shown in Table 4S (Appendix 4, Supplementary material). The 10 topics that obtained the highest scores regarding challenges to overcome in the presence of the COVID-19 pandemic are described in Table 2, and were focused on new technologies, diagnostic tests, role of nursing, patient's referral, protocols, leadership, patients' follow-up and education, new reality, and change of mentality.

Recommendations

A set of 19 recommendations were established in the areas of coordination between primary care and specialized care consultation (4 recommendations), optimization of lung function testing (3 recommendations), implementation of telemedicine (9 recommendations), and role of nursing and hospital pharmacy (3 recommendations) (Table 3). In the area of coordination between primary care and specialized care, important recommendations included to review and improve referral protocols, the promotion and training of virtual consultation platform to optimize patient's referral to the appropriate setting, to establish training programs for primary care clinicians, and to appoint a reference doctor for the management of severe asthma in primary care.

In relation to optimization of lung function testing, it was recommended to determine the minimum number of tests to be performed, to promote the performance of spirometry in primary care, and to adapt resources and spaces to ensure optimal safety standards during performance of tests. In the section related to telemedicine, participants recommended videoconferencing, mobile apps, telephone calls, or integral virtual platforms for the follow-up of patients, definition of the model of care (face-to-face, telematics, mixed) according to the patient's individual needs, self-administration of biologics for treatments at home, and definition of the legal and ethical framework for virtual patient care. Patients' follow-up via telephone calls by the nursing staff was also recommended. With regards to the role of nursing and hospital pharmacy, the involvement of the nursing staff in consultations of asthma units with the implementation of a case manager nurse was recommended, as well as development and promotion of hospital pharmacy in coordination with asthma units for the follow-up of patients treated with biologics.

On the basis of these proposals, four recommendations were selected (Table 4). These final recommendations were addressed to overcome specific challenges posed by COVID-19 pandemic and their implementation would be associated with a remarkable impact on the patients' care in clinical practice.

Discussion

This study presents the consensus obtained by pulmonologists and allergologists who were experts in severe asthma regarding the main challenges posed by COVID-19 pandemic and the main recommendations for action. These included maintaining the quality of care in virtual visits, adequacy on the use of lung function tests, to promote effective use of telemedicine in daily practice, and to consolidate the empowerment of nursing in asthma units. A next step based on these findings would be to present these recommendations to the health authorities to gain their support for effective changes and implementation in daily practice.

During the course of workshops, all participants categorically expressed how COVID-19 pandemic had significantly affected their professional activity. There was a general agreement on the crucial role played by nursing in making telephone contacts with patients and assessing their needs, how consultations had to be cancelled for some time and staff restructuring for COVID-19 sick leaves, the use of telemedicine or phone calls because of difficulties (or impossibility) to see patients during the acute phase of the pandemic, and the importance of hospital pharmacy for facilitating self-administration of biologic treatments. Also, restrictions applied particularly regarding aerosol exposure, limited the use of lung function testing and diagnostic studies in general. All these aspects raised concern about the possibility of complications related to inadequate monitoring and follow-up. Similar problems have been reported in other specialties. In ear, nose, and throat (ENT) department from northern Italy, De Bernardi et al. (19) described significant reduction in daily visits, with procedures mainly cancelled or postponed, and structural reorganization of the service. In other diseases and health care systems, such as the 2014–2015 Ebola outbreak in West Africa, the consequences of reducing access to health services for diagnosis and treatment have been catastrophic with increasing the mortality rates of malaria, HIV/AIDS, and tuberculosis that are endemic to the region (20).

Guidelines of scientific societies have provided recommendations on the management of asthma in patients with SARS-CoV-2 infection (11, 12, 21) and indicate that lung function testing and induced sputum testing should not be performed (or not performed routinely) in order to prevent exposure to aerosols and the spread of COVID-19 disease (22). In fact, restrictions for lung function testing and face-to-face consultations are important difficulties in the management of asthma patients, particularly at the time of diagnosis and, in many cases, at follow-up. A consensus-based ad-hoc expert panel of allergy/immunology specialists from the United States and Canada established criteria for face-to-face visits and virtual encounters according to the severity and degree of control of asthma, or to postponed/delayed or handled through virtual care (23). Although services have moved from towards telephone triage and remote care, tests involving objective measurements, such as oxygen saturation and peak expiratory flow, or presenting symptoms (trouble breathing, auscultation of wheezing) may present difficulties as home testing is not always feasible. It is recommended augmenting the consultation with video for additional visual cues and examination, including the general appearance of the patient, work of breathing, and if time allows, inhaler technique can also be checked (24).

Telemedicine has been increasingly used to improve health outcome in asthma prior to COVID-19 pandemic. In a systematic review and meta-analysis of 22 studies with 10 281 participants, it was found that combined tele-case management and tele-consultation could significantly improve asthma control compared with usual care, and appeared to be effective telemedicine interventions to improve asthma control and quality of life in adults (25). A Cochrane systematic review of six parallel randomized controlled trials (RCTs) of 2100 adults or children with asthma, published in 2016, compared the efficacy of remote check-ups conducted using any form of technology versus standard face-to-face consultations (26). This study could not demonstrate any important differences between both modes of consultation in terms of exacerbations, asthma control

or quality of life. Moreover, exacerbations that needed treatment in the emergency room, hospital admission or an unscheduled health care visit all happened too infrequently to detect whether remote check-ups were a safe alternative to face-to-face consultations (26). However, during the COVID-19 pandemic, the use of telemedicine has changed from being an optional way to see patients to becoming a necessity incorporated into everyday practice. During limitations imposed by the lockdown, experiences in other specialties have shown the value of telemedicine to provide adequate treatment and follow-up, such as in patients with low urinary tract symptoms due to benign prostatic hyperplasia (27), or telehealth to conduct hospital psychiatric services (28). In the field of asthma, Persaud and Portnoy (29) have offered rules for starting a telemedicine program to care for patients with asthma, with emphasis on the selection of the appropriate type of telemedicine and a simple platform, building the infrastructure, preparation of the visit in advance, and being aware of national laws regarding telemedicine and to get the informed consent. However, no previous studies have examined the implementation and results of telemedicine for asthma patients during COVID-19 pandemic.

Nurses have played a prominent role during COVID-19 pandemic by using telehealth and other forms of remote working (30). In the present study, there was consensus on the involvement of nursing staff in the consultations of asthma unit, with the figure of the case manager nurse, and to develop training plans adapted to the needs of patients with severe asthma addressed to nurses and hospital pharmacy staff. Another question discussed in the workshops was the role of hospital pharmacy in the administration of biologics for severe asthma. In this respect, other authors have reported implementation of self-injection programs and switch to prefilled syringes/autoinjectors for biologics to minimize exposure to the hospital (31).

Although the reduced number of participants may be view as a limitation of the study, all of them were specialists in respiratory medicine and allergology working in officially accredited asthma units with a large experience in the management of severe asthma patients. However, the panel was limit to pulmonologists and allergist and therefore we did not receive input of primary care physicians, nurses, or patients. The specific proposals in response to the effect of COVID-19 pandemic focused on four areas of interest related to improvement of the coordination between primary care and specialized care, optimization of lung function testing, implementation of telemedicine, and empowerment of the role of nursing and hospital pharmacy, in particular for follow-up and self-administration of biologics at home may be generalized to other health care settings. Further consensus documents for asthma management supported by qualified experienced professionals are needed for overcoming the challenges of living with COVID-19.

Authors' contributions

Conflicts of interest: C. Martínez Rivera: personal fees as a speaker, scientific advisor, and participation in clinical studies from AstraZeneca, Chiesi, GlaxoSmithKline, Mundifarma, Novartis, and Teva; A. Crespo-Lessman: personal fees from Novartis, Chiesi España, Laboratorios Esteve, Ferrer, Zambon, Boehringer Ingelheim, Bial, Teva, FAES Farma, and grants and persona fees AstraZeneca, outside the submitted work; E. Arismendi: fees for training and consultancy from AstraZeneca, GSK, Chiesi, and Novartis; M. Muñoz-Esquerre: honoraria as a speaker, scientific advisor or participation in clinical studies from AstraZeneca, Chiesi, GlaxoSmithKline, Menarini, Mundifarma, Novartis, Ferrer and Teva.

; X. Aguilar: none to be declared; P. Ausín: personal fees as for training and consultancy by Astra-Zeneca, GSK, Chiesi, and Novartis; I. Bobolea: received honoraria from Novartis, GSK, Teva, Astra Zeneca, and Chiesi for speaking at symposia, member of advisory boards, and financial support from these companies for attending scientific symposia and other educational programs; G. Dalmau Duch: none to be declared; R. Pifarré Teixido: none to be declared; G. Sabater Talaverano:

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Table 1. Selection of the 10 topics with the highest score regarding the impact of COVID-19 pandemic on asthma units.

Topic	Main concepts	Distribution of 100 points, %
Workforce and consultations	– Sick leaves of professionals due to COVID-19. – Cancellation or reduction of consultations.	21
Relevant role of nursing/hospital pharmacy	– Managing patients who cannot come to the hospital. – Greater involvement of nursing case managers. – Administration of treatments.	18
Virtual visits and telemedicine	– Dramatic reduction of face-to-face visits. – Increase of telephone/virtual contact. – Improvement of equipment (cameras/telephones)	14
Stress/emotional impact	– High psychological impact. – Work overload and lack of experience.	12
Diagnostic studies	– Impossibility to perform some studies due to restructuring of processes in the unit. – Marked reduction in the request of diagnostic tests.	9
Treatment at home	– Self-administered medications at home – Need for rapid training to patients/families on biological drugs.	8
Team feeling	– A lot of camaraderie and union between professionals.	6
Clinical protocols	– Need to update and develop protocols in response to long waiting lists. – Development of new post-COVID action protocols.	5
Uncertainties/difficulties	– Adaptation to the patients' care in a virtual environment. – Patients' distrust due to loss of personal contact with their doctors.	4
Patients' response	– Acknowledgement and good patients' response to telephone/virtual contact with professionals.	3

Table 2. Selection of the 10 topics of with the highest scores regarding challenges posed by COVID-19 pandemic to asthma units.

Topic	Main concepts	Distribution of 100 points, %
New technologies	– Adequate implementation of new technologies. – Maintenance of the use of telemedicine over time. – Increase the volume of patients attended based on reduced effective time for face-to-face visits.	18
Diagnostic studies	– Define and prioritization of patients requiring diagnostic studies and which tests. – Limit the requests of lists of diagnostic tests and restriction to those that are more relevant. – Improve adherence that may result from the use of fewer diagnostic studies.	15
Role of nursing	– To ensure empowerment of nursing staff	14
Patient's referral	– Establish rapid and effective criteria for referral/transitions from primary care to specialised care.	11
Clinical protocols	– Establish and maintain safe protocols for patients and health care professionals.	9
Leadership	– Assume a leadership role in the patients' follow-up. – Determine the degree of leadership in non-critical patients.	8
Patients' follow-up	– Follow-up of quality beyond telephone contact. – Patients' control in the new scenario/real world.	7
Education	– Patients' education in the new management of virtual visits.	7
New reality	– Maintain the new form of care over time. – Characterize the patient's profile to adapt the care to his/her needs. – Learn how to manage the new working model and educate patients.	6
Change of mentality	– In response to the current circumstances posed by COVID-19 pandemic	5

Table 3. Recommendations for the management of severe asthma patients during COVID-19 pandemic.

Area of interest	Recommendations
Coordination between primary care and specialized care	1. Review and redefinition of referral protocols from primary care to specialized care. 2. Promotion and training in the correct use of the virtual consultation platform to optimize the referral and follow-up of chronic patients controlled between primary care and specialized care and between specialized care and the asthma unit. 3. Development of training programs by specialists addressed to primary care clinicians. 4. Appointment of reference doctors for the management of severe asthma in the primary care centers.
Optimization of lung function testing	5. Identification of the minimum lung function tests to be performed in the diagnosis and follow-up of the different types of patients and preparation of a guide of recommendations to support decision-making. 6. Promotion of spirometry tests from health centers (primary care/specialized care) and inclusion of apps allowing the test to be performed telematically. 7. Adequacy and adaptation of the resources and physical spaces available to ensure optimal safety standards during the performance of lung function test.
Implementation of telemedicine	8. Promotion of videoconferencing systems with access to clinical information on patients and provision of the necessary equipment and technological resources. 9. Preparation of targeted and adapted communications for both health care professionals and patients, with specific instructions for the correct use of telemedicine tools. 10. Definition of the legal and ethical framework in relation to virtual patient care and the processing of personal data. 11. Design and implementation of mobile apps allowing clinicians to monitor patients through the digitization of asthma questionnaires and enable communication channels between patients and doctors. 12. Development of gamification-based training adapted to the needs of patients. 13. Development of a virtual platform that integrates all digital content designed for the patient allowing specialists to follow-up and control of patients. 14. Promotion of telephone follow-up by the nursing staff. 15. Definition of criteria to carry out face-to-face, telematics or mixed control and stratification of patients in relation to the model of care that best suits their needs. 16. Promotion of the model of self-administration of biologics, in which patients are treated at home and face-to-face visits are alternated with follow-up telephone visits.
Nursing and hospital pharmacy	17. Definition of training plans adapted to the needs of patients with severe asthma addressed to both hospital pharmacy and nursing. 18. Promotion of the involvement of nursing staff in the consultations of the asthma unit (case manager nurse). 19. Development or promotion of biologics consultations carried out by hospital pharmacy in coordination with asthma units for the follow-up of patients under biologic therapies.

Table 4. Final recommendations for improving patients' care during COVID-19 pandemic.

Area of interest	Challenge to overcome	Recommendation	Impact generated in daily practice
Coordination between primary care and specialized care	To maintain the quality of care in virtual consultations	Promotion and training in the correct use of the virtual consultation platform to optimize the referral and follow-up of chronic patients managed between primary care and specialized care and between specialized care and the asthma unit	Improves the approach of chronic controlled asthma patients and candidates to be treated in asthma units
Optimization of lung function testing	To assess the value provided by the different lung function tests and to reduce their overuse	Identification of the minimum lung function tests to be performed in the diagnosis and follow-up of the different types of patients and preparation of a guide of recommendations to support decision-making	Ensures that only indispensable lung function tests will be performed reducing workload and avoiding trips to the hospital
Implementation of telemedicine	To include new systems for patients' follow-up and monitoring in daily clinical practice	Design and implementation of mobile apps allowing clinicians to monitor patients through the digitization of asthma questionnaires and enable communication channels between patients and doctors.	Improves the follow-up of patients
Nursing and hospital pharmacy	To consolidate the empowerment of nursing staff in the asthma units	Promotion of the involvement of nursing staff in the consultations of the asthma unit (case manager nurse)	Reduces the burden of workload for specialists

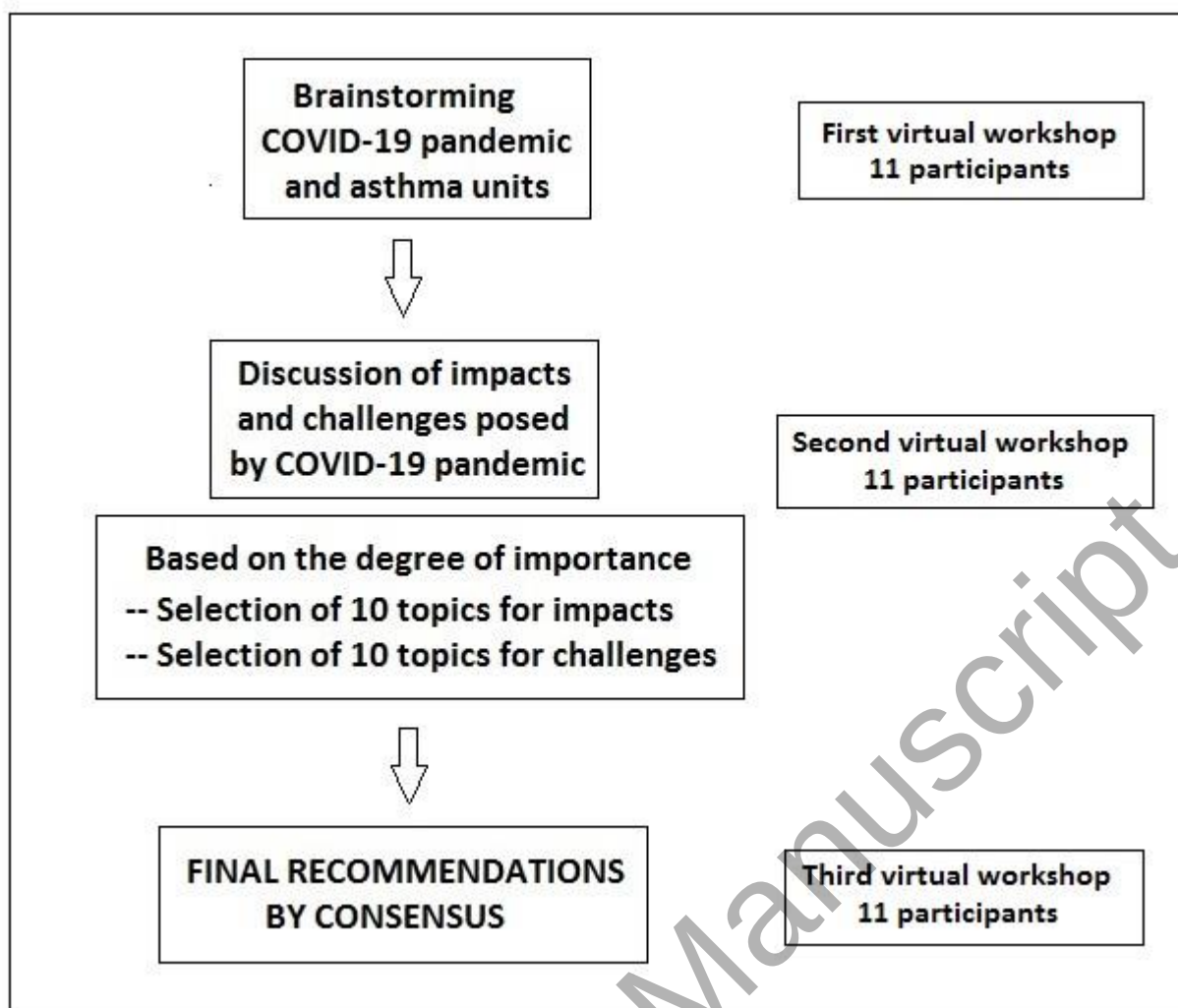


Figure 1. Sequence of events to achieve final recommendations for the management of asthma units during COVID-19 pandemic.

Supplementary material

Appendix 1

Table 1. Impacts of COVID-19 pandemic on health care professionals of asthma units

- Generation of anxiety due to the high health care pressure, the risk of contagion and not having experience in the disease.
- Multiple sick leave of professionals from the asthma unit due to COVID-19.
- Relocation of professionals from their usual consultations and interruption of activity due to modification of the structure to organize care for COVID-19 patients. In many Units, all professionals were relocated to manage COVID-19.
- Situation of overwhelm and stress due to the high number of patients who were admitted on a daily basis.
- High emotional impact and exhaustion derived from the situation of overload of work in the professionals.
- Increased team feeling and value of work done.
- Change of the model of patients' care and follow-up from face-to-face to via telephone. A large percentage of face-to-face visits had to be reduced or canceled directly.
- Reduction of the number of lung function tests performed.
- Uncertainty on a daily basis.
- Express training for patients and accompanying persons on biological agents.
- It has been detected that the asthma units are not prepared for alarm situations, being necessary contingency plans to reduce the impact of future alarms.
- Professionals have had to play multiple roles within the unit.
- The implementation of home-based strategies had to be promoted.
- The role of nursing and hospital pharmacy has been crucial and they have gained protagonism in the management of patients.
- In addition, the role of nursing has been fundamental, assuming a very relevant role in the administration of treatments to patients.
- Fundamental role of nursing case managers (telephone follow-up of patients).
- Lack of knowledge regarding the evolution of COVID-19 pandemic.
- Solutions were sought to provide the drugs to patients.
- They have had to start doing face-to-face on calls.
- At the service level, working hours have been affected due to social distancing rules.
- Units have been strengthened.

Supplementary material

Appendix 2

Table 2. Impacts of COVID-19 pandemic on patients of asthma units

- Uncertainty about the telematics follow-up, they received it positively since they did not want to travel to the hospitals but the loss of contact with the clinicians could generate distrust among patients in the short and medium term.
- In the long term a more personalized follow-up of patients will be necessary; telephone follow-up may not be sufficient.
- Patients have been grateful, they have not felt abandoned.
- Delay in performing diagnostic tests and starting treatment.
- Some patients decided to stop treatment for fear of contagion if they went to the hospital (low percentage).
- Follow-up of a new group of patients with COVID-19-related sequelae.
- Generation of anxiety among patients as it is an infection that also affects the respiratory system.
- By considering the asthma patient as a population at risk, the impact on the group has been considerably minimized.
- Training activities adapted to patients in relation to COVID-19 and how it affects their pathology have been carried out.
- It has been observed that the use of masks in asthma patients can increase their underlying condition.
- It was possible to identify patients who were visited without being strictly necessary.
- Patients appreciate the presence and the role of the nursing staff during the follow-up phase.
- The need to inform patients of both the risk of contracting COVID-19 and its link with asthma has been detected.

Supplementary material

Appendix 3

Table 3. Impacts of COVID-19 pandemic on processes in asthma units

- Reduction of available consultation times.
- Implementation of cleaning and protection protocols at the hospital and service levels.
- Limitation of waiting room space.
- Cancellation of visits and telephone follow-up (except for patients with pulmonary cancer, who have continued to visit).
- Promoting telemedicine. Provision of the necessary equipment in the consultations with cameras and telephones to carry out visits in a virtual or telematics way.
- Reduction or cancellation of pulmonary function tests (either by reducing the displacement of patients to the hospital, or by the difficulty of continuously disinfecting certain equipment necessary to perform certain tests). The request for tests has been considerably reduced by professionals.
- Saturation of the waiting list and difficulty in rescheduling all patients.
- They have had to make adaptations in their current spaces to be able to carry out pulmonary function tests (e.g. implementation of negative pressure in rooms where certain pulmonary function tests are performed).
- The use value and confidence in self-administered treatments has increased thanks to the delivery of therapies at home, without the need for patients to travel.
- Appearance of the nursing figure to carry out monitoring via telematics.
- Development of new post-COVID action protocols.
- Increase in waiting lists for both first visit and follow-up controls.
- The need to perform PCR prior to pulmonary function tests (e.g. spirometry) has made it the test with the longest waiting list today.
- In some centers, patients treated with biologics are being treated on a day-care basis.
- Work is being done on updating protocols for the management of patients treated with biologic drugs.

Supplementary material

Appendix 4

Table 5. Challenges identified in the presence of the COVID-19 pandemic

- Priorization of patients who need lung function testing.
- Limit and prioritization of the request for lung function testing.
- To establish safe protocols for patients and health care professionals.
- Limit examinations at the hospital and encourage those that can be performed by the patient at home.
- Training of patients in those cases where function tests are carried out at home.
- Assume the leadership role in monitoring COVID-19 (in certain units and cases).
- To determine the degree of leadership to be assumed in non-critical patients.
- To increase the volume of assistance with less effective time for face-to-face consultation.
- To perform a follow-up of patients of quality beyond follow-up by phone.
- Role of video calling versus telephone contact.
- Incorporation of telemedicine in the usual dynamics of consultations.
- To better define the profile of patients to adapt the care to be provided.
- To ensure the empowerment of the nursing role.
- Definition of easy and fast criteria between primary care and specialized care.
- Management of the change of paradigm and mentality in the units because all lung function tests could not have been used as before.
- Empower the patient of his/her disease through technologies and new established circuits.
- Educate the patient in the new management of virtual consultations.
- To learn how to manage Learn the new working model and to maintain it over time.
- Definition of safety protocols for health care professionals.
- Reduction of face-to-face visits and potentiation of telemedicine.
- Definition of protocols to maintain a safe distance between patients in the waiting rooms.
- Definition of protocols for alternating face-to-face and virtual visits.
- Empower nursing for the follow-up and education of patients.
- Development of initiatives to individualize the type of care to be provided and to improve patient's knowledge of the disease and treatment.