Research Article

Management of Chronic Obstructive Pulmonary Disease: Constraints in Patient Pathway and Mitigation Strategies

Ana S. Cunha[a]   Beatriz Raposo[a]   Filipe Dias[a]   Susana Henriques[b]
Hugo Martinho[c]   Ana R. Pedro[a, d]

[a]NOVA National School of Public Health, Public Health Research Center, CISP, NOVA University Lisbon, Lisbon, Portugal; [b]AstraZeneca Portugal, External Affairs, Barcarena, Oeiras, Portugal; [c]AstraZeneca Portugal, Medical Affairs, Barcarena, Oeiras, Portugal; [d]NOVA National School of Public Health, Public Health Research Centre, Comprehensive Health Research Center, CHRC, NOVA University Lisbon, Lisbon, Portugal

Abstract

Introduction: Respiratory diseases, ranking the third in Portugal, contribute significantly to illness and mortality. Chronic obstructive pulmonary disease (COPD) is the third-leading cause of death globally. Identifying high-risk individuals and implementing early treatment is crucial due to the variability of COPD symptoms and exacerbations. This study aimed to identify effective strategies for preventing exacerbations and complications. *Methods:* A Delphi involving 15 experts was performed. Experts included physicians, nurses, health managers, policymakers, public health experts, and patient organizations. Consensus was achieved at 73.3% for each strategy using a scale ranging from "agree" to "disagree." Three rounds were conducted to address six questions related to early diagnosis and patient follow-up. Challenges faced by the Portuguese Health System in managing COPD, obstacles in COPD exacerbation diagnosis and management, and effective strategies to overcome barriers were identified in the first round. The second and third rounds involved analyzing the gathered information and voting on each indicator to achieve consensus, respectively. Indicators were categorized into constraints and barriers, and strategies for reducing COPD exacerbations and disease burden. *Results:* Out of a total of 134 valid indicators generated, 108 achieved consensus. Among the indicators agreed upon by experts, 18 pertained to barriers, challenges, and constraints, while 90 focused on action strategies for COPD. Among the strategies formulated, 25 consensus indicators target prevention strategies, 24 consensus indicators aim to enhance COPD referrals, and 41 consensus indicators focus on mitigating COPD exacerbations and reducing the overall disease burden. *Discussion/Conclusion:* This study emphasizes the need for integrated investment in respiratory healthcare and recognition of the impact of COPD on patients, healthcare systems, and economies. Prevention and appropriate treatment of exacerbations are crucial for effective COPD management and reducing associated morbidity and mortality. Experts highlight the importance of improving coordination between different levels of care, integrating information systems, and decentralizing hospital responsibilities. The COVID-19 pandemic has further emphasized the importance of individual and collective respiratory health, necessitating investment in health promotion and COPD awareness.

© 2024 The Author(s). Published by S. Karger AG, Basel on behalf of NOVA National School of Public Health

Correspondence to:
Ana R. Pedro, rita.pedro@ensp.unl.pt

Gestão da doença pulmonar obstrutiva crónica: Constrangimentos no percurso dos doentes e estratégias de atenuação

Palavras Chave

Doença pulmonar obstrutiva crónica · Gestão da doença · Técnica Delphi · Acesso aos serviços de saúde

Resumo

Introdução: As doenças respiratórias são uma das principais causas de doença e morte, ocupando o terceiro lugar em Portugal. Globalmente, a Doença Pulmonar Obstrutiva Crónica (DPOC) é a terceira principal causa de morte, a seguir às doenças cardiovasculares e ao acidente vascular cerebral. Identificar indivíduos de alto risco e implementar tratamento precoce é crucial devido à variabilidade dos sintomas e exacerbações na DPOC. Este estudo teve como objetivo determinar estratégias eficazes para prevenir exacerbações e complicações relacionadas. *Métodos:* Foi desenvolvido um estudo Delphi que envolveu 15 especialistas de diversas áreas, incluindo médicos, enfermeiros, gestores de saúde, decisores políticos, especialistas em saúde pública e representantes de organizações de pessoas com doença. Os especialistas utilizaram uma escala, variando de "Concordo" a "Discordo", para alcançar um nível de consenso de 73,3% para cada estratégia. Foram realizadas três rodadas para abordar seis perguntas relacionadas com o diagnóstico precoce e seguimento dos doentes. A primeira ronda centrou-se na identificação dos principais desafios enfrentados pelo sistema de saúde português na gestão da DPOC, dos obstáculos na identificação e gestão das exacerbações da DPOC e das estratégias eficazes para ultrapassar as barreiras identificadas. A segunda e a terceira rondas envolveram a análise da informação recolhida e a votação de cada indicador para obter consenso. Os indicadores resultantes foram categorizados em dois grupos: barreiras, desafios e constrangimentos na gestão da DPOC e estratégias de ação para melhorar a prevenção, a referenciação e diminuir exacerbações e o peso desta doença. *Resultados:* De um total de 134 indicadores válidos gerados, 108 obtiveram consenso. Dos indicadores consensualizados pelos peritos, 18 dizem respeito a barreiras, desafios e constrangimentos, enquanto 90 são referentes a estratégias de ação para a DPOC. Entre as estratégias formuladas, 25 indicadores com consenso visam estratégias de prevenção, 24 indicadores com consenso têm como alvo a referenciação da DPOC e 41 indicadores com consenso concentram-se em mitigar as exacerbações da DPOC e reduzir a carga da doença. *Discussão/Conclusão:* Este estudo enfatiza a necessidade de investimento integrado na saúde respiratória e o reconhecimento do impacto da DPOC na vida das pessoas, nos sistemas de saúde e na economia. A prevenção e o tratamento adequado das exacerbações são cruciais para uma gestão eficaz da DPOC e para reduzir a morbidade e a mortalidade associadas. Os especialistas destacam a importância de melhorar a coordenação entre diferentes níveis de cuidados, integrar sistemas de informação e descentralizar as responsabilidades hospitalares. A pandemia da COVID-19 reforçou a importância da saúde respiratória individual e coletiva, enfatizando a necessidade de investir na promoção da saúde e na consciencialização sobre a DPOC.

Introduction

In developed countries, such as Portugal, there has been a consistent rise in average life expectancy, primarily attributed to advancements in scientific medicine, implementation of public health interventions, and enhanced availability of innovative and efficacious therapies [1]. Nevertheless, this positive trend is accompanied by a surge in the prevalence of chronic conditions, specifically respiratory diseases [2]. Respiratory diseases contribute substantially to both morbidity and mortality, ranking as the third most common cause of death globally, following cardiovascular diseases and stroke, particularly among individuals aged 65 and above [2, 3].

Chronic obstructive pulmonary disease (COPD) stands as the primary cause of fatality within the realm of respiratory diseases, resulting in death of approximately 3.2 million individuals annually [2–5]. The "Health at a Glance – Europe 2022" report has recognized COPD as a prominent preventable cause of death since 2019 [2], highlighting the potential for reduction through the implementation of prevention and disease management strategies beyond the hospital setting [2, 6]. In Portugal, according to the Burden of Obstructive Lung Disease study, published in 2013,

COPD ranks among the most prevalent chronic health conditions, affecting an estimated 14.2% of individuals aged 40 and above, with a significant proportion of cases going undiagnosed [1, 2, 7]. Respiratory diseases are also accountable for 19% of in-hospital mortality [2, 8]. COPD causes persistent and progressive respiratory symptoms, encompassing dyspnea (difficulty in breathing), coughing, and excessive production of sputum [9]. The progression of the disease is intricately linked to the severity and frequency of exacerbations, which have both short-term and long-term clinical implications [10]. COPD exacerbations significantly impact the prognosis of the disease, amplifying its overall severity by diminishing lung function and elevating morbidity and mortality rates [11]. Specifically, the occurrence and frequency of COPD exacerbations are closely associated with an increased risk of hospitalization, an increase in cardiovascular events, increased levels of anxiety and depression, limitations in physical activity, an increase in individual healthcare expenditure, an increase in healthcare-related costs, and a decrease in the quality of life of individuals with COPD [10, 12–15].

Therefore, COPD exerts a significant economic burden [16]. The direct costs attributed to COPD amount to 6% of the total healthcare expenditure within the European Union, corresponding to EUR 38.6 billion annually and encompassing 56% of the overall expenditure on treating respiratory diseases [17]. Nevertheless, the impact of COPD extends beyond the direct costs alone. The functional limitations imposed by the disease, impeding individuals from carrying out daily tasks independently, can result in heightened reliance on caregivers. Moreover, this, in turn, contributes to additional indirect costs arising from work absenteeism and decreased productivity [13]. In terms of disease burden, the global burden of disability-adjusted life years attributed to COPD amounted to approximately 81.6 million, signifying the substantial impact and disabling nature of COPD on affected individuals [18].

Considering these observations, the current scenario prompts the emergence of the following scientific questions: What are the main barriers preventing the most appropriate follow-up of individuals with COPD and what are the key approaches to mitigate these barriers? In response to these queries, the objective of this study was to identify and establish a consensus regarding the impediments encountered during the follow-up of individuals with COPD, along with potential strategies to improve these challenges. Additionally, the study sought to explore plausible strategies for preventing exacerbations and mitigating associated complications.

Methods

Study Design

To fulfil the predetermined objectives of this study, the Delphi technique was performed. The Delphi technique, widely utilized in qualitative research, is a consensus-building methodology aiming to attain agreement on a complex issue through a systematic forecasting process that leverages the collective expertise of a group of specialists [19, 20]. This technique represents a dependable tool for generating novel concepts and delineating the trajectory of future-oriented research endeavors [21]. The technique entails a meticulously structured board involving the participation of recognized experts in relevant fields of study, possessing profound knowledge of the subject matter at hand, thereby ensuring their credibility [20, 22]. This study convened a multidisciplinary panel of experts, encompassing seven physicians (three family medicine physicians, three pneumologists, and one internal medicine physician), two nurses, two health managers (one from primary care and one from hospital care), two policymakers, one expert in public health and health promotion, and one representative from patient organizations.

The Delphi process comprises three successive rounds of data collection [19, 23]. The main objective of the initial round was to identify the principal constraints encountered within the Portuguese Health System regarding COPD management, as well as to identify the key challenges related to the identification and management of COPD exacerbation risk within the same context. To achieve this goal, a set of six open-ended questions was posed.

In the first question, the experts were tasked with identifying persistent barriers and constraints to COPD management in Portugal, despite the advancements and improvements made thus far. The second question aimed to gather insights on potential actions to enhance the effectiveness of COPD prevention in Portugal. The third question focused on how COPD diagnosis is currently conducted in Portugal and sought to identify factors contributing to delayed diagnosis. Moving to the fourth question, the experts were requested to express their opinions on the referral process for COPD patients within the Portuguese Health System and propose suggestions for improvement. The fifth question requested the experts to propose strategies for reducing exacerbations and lessening the burden of COPD in Portugal. Finally, in the sixth question, the experts were asked to provide their comments on the available resources and tools for the adequate follow-up of individuals with COPD.

After the initial round, which consisted of open-ended questions, the second round involved the presentation of indicators derived from the previous round. The experts were then prompted to indicate their level of agreement with each item. An online form was used to allow experts to express their agreement using a Likert scale, which included options such as "agree," "neither agree nor disagree," and "disagree." Moreover, experts were given the opportunity to propose new indicators that they deemed relevant.

In the third and final round, the distribution of votes for indicators that did not achieve consensus in the previous round was presented graphically. Experts were given the chance to maintain or modify their level of agreement with these indicators.

Additionally, voting was conducted for the indicators introduced during the second round. The results of each round were consistently shared with the group anonymously to mitigate any potential biases stemming from experts' apprehension about their opinions being negatively perceived or influenced by personal factors [23].

Data Analysis

A consensus threshold of 73.3% agreement (requiring at least 11 out of 15 experts) was established for each indicator. In other words, for an indicator to be considered consensual, it necessitated a minimum of 73.3% agreement among responses, encompassing the options of "agree," "neither agree nor disagree," or "disagree." Upon completion of the Delphi panel, the indicators obtained were categorized into two distinct groups: (1) identification of barriers, challenges, and constraints in COPD management and (2) identification of operationalizable strategies to enhance prevention, referral processes, reduce exacerbations, and alleviate the burden associated with this disease.

Results

A total of thirty experts were invited to participate in the Delphi technique, of which 50% expressed their agreement to participate and maintained full cooperation throughout all three rounds, resulting in a 100% response rate. Across the six questions posed, a total of 134 valid indicators were obtained. Out of these, 108 indicators achieved consensus, with a predominant level of agreement in the "agree" category. Among the consensus indicators, 18 pertained to the group of barriers, challenges, and constraints in COPD management, while 90 indicators were associated with the group of action strategies aimed at improving prevention and referral processes, reducing exacerbations, and alleviating the burden of this disease.

Regarding the results pertaining to barriers, challenges, and constraints in COPD management, several indicators garnered significant consensus within this group. The indicators that achieved the highest level of agreement were as follows: "late diagnosis due to the lack of spirometry in primary healthcare" (100% agreement), "late performance of spirometry" (100% agreement), "late diagnosis due to patients' underestimation of symptoms" (93.3% agreement), and "low use of spirometry in primary healthcare" (93.3% agreement). A detailed summary of these indicators can be found in online supplementary Table S1 (for all online suppl. material, see https://doi.org/10.1159/000535474). For the purpose of content analysis, the findings pertaining to action strategies were categorized into three distinct groups: [1] action strategies aimed at enhancing the prevention of COPD (25 indicators), [2] action

strategies aimed at improving the referral process for COPD (24 indicators), and [3] action strategies aimed at reducing exacerbations and alleviating the burden associated with COPD (41 indicators).

Considering the key findings regarding action strategies for COPD prevention, several indicators garnered significant consensus among the experts. The indicators with the highest level of agreement were as follows: "implementation of smoking prevention measures through smoking cessation campaigns" (100% agreement), "emphasis on training and capacity-building campaigns for primary prevention of exposure to risk factors" (100% agreement), "establishment of early smoking intervention teams for monitoring purposes" (100% agreement), " smoking cessation appointments in primary healthcare, with increased proximity" (100% agreement), "increased implementation of smoking prevention campaigns in schools and through media channels" (100% agreement), "create means for early help in smoking cessation" (100% agreement), and "existence of follow-up teams in early smoking intervention" (100% agreement). Further details on these indicators can be found in online supplementary Table S1.

Simultaneously, experts voted on action strategies to enhance COPD referral. These strategies, as most voted, include: "enhancement of information system sharing and interoperability" (100% agreement), "improved coordination between primary healthcare and hospitals" (93.3% agreement), "empowerment of patients in their care journey" (93.3% agreement), "integrated collaborative approaches to patient management" (93.3% agreement), and "implementation of an alternative referral model to prevent patients from being caught in a "ping-pong" effect" (93.3% agreement). Additional information about these indicators can be found in online supplementary Table S1.

The action strategies with the highest consensus level, targeting the reduction of COPD exacerbations and the alleviation of disease-related burdens, are as follows: "adequacy of therapeutic regimens to the severity and Global Initiative for COPD assigned" (100% agreement), "improve clinical information sharing" (100% agreement), "improve articulation between the hospital, primary healthcare, and home care" (100% agreement), and "greater empowerment of patients and professionals" (100% agreement). Additional information concerning these indicators can be found in online supplementary Table S1. The comprehensive list of indicators, encompassing both "consensus" and "nonconsensus" indicators put forth by the experts, is provided in online supplementary Table S1 for reference.

Cunha/Raposo/Dias/Henriques/Martinho/Pedro

Discussion

The application of the consensus-building technique in this study facilitated the identification of a set of consensus indicators pertaining to potential constraints in patient follow-up, along with strategies to mitigate these challenges, as determined by a panel of 15 experts in pulmonology-related fields from Portugal. The results obtained underscore the imperative of investing in respiratory health [24]. Prevention and prompt treatment of exacerbations were acknowledged as crucial strategies in managing the disease and reducing associated morbidity and mortality, thereby emphasizing the significance of timely therapy and its impact on the prognosis [25, 26]. According to the experts, investing in the training and education of healthcare professionals on COPD, particularly in primary healthcare settings, emerges as a pivotal factor for effective prevention and timely diagnosis [6, 27, 28]. By fostering the development of family medicine and respiratory health-specialized nurses in primary care, there is potential for the screening and management of mild and moderate stages of COPD at this level, thereby minimizing excessive referrals to hospital care and optimizing resource utilization [6, 27, 28]. It is of utmost importance to enhance coordination, integration, and collaboration among primary healthcare, hospital care, home care, and/or outpatient care, while also considering the decentralization of hospital competencies as part of a comprehensive approach [29].

Simultaneously, the experts emphasized the significance of embracing "digital transition." Leveraging digital platforms to enhance the response to COPD entails the utilization of telemonitoring and/or telerehabilitation services for remote monitoring and rehabilitation, enabling timely access to information on vital functions and identification and prevention of exacerbations [17, 30, 31]. By employing telehealth services, COPD patients can minimize their visits to healthcare facilities, thus saving time and resources, receiving appropriate care, and enhancing their access to specialized services [14, 17, 31–33].

Multiple findings corroborated the significance of prevention and early identification strategies, including smoking cessation, timely utilization of spirometry, and health promotion/education [17, 27, 34]. Individually, the findings underscored the necessity of enhancing COPD literacy as it plays a pivotal role in symptom recognition, disease awareness, and timely initiation of therapy, thereby facilitating improved disease management [17, 27]. Furthermore, the experts highlighted the imperative of developing COPD indicators specifically tailored for primary healthcare, encompassing pediatric indicators as well [34].

The feasibility of conducting screening and testing for respiratory diseases, including spirometry, in pharmacies was proposed as a potential solution to facilitate early detection and increase awareness of these diseases, which is consistent with the results of the scoping review conducted by Valentino et al. [35], which reports that pharmacist-provided spirometry services can increase patient access to diagnostic tests and primary care providers' access to results. In addition, our experts also highlighted the crucial role of pharmacists in providing education on the proper use of respiratory equipment, which is also consistent with other studies [36–39]. Furthermore, engaging other professionals such as respiratory nurses or cardiopulmonary technicians in pharmacies or primary care clinics to provide education and address concerns could have a profoundly positive impact on the community [40].

Environmental pollution exerts a direct impact on the onset and progression of respiratory diseases, emphasizing the significance of intervention at this level [17, 41–43]. Controlling pollution levels, both outdoors and indoors, as well as monitoring pollen concentrations, holds crucial importance for individuals with respiratory conditions [41, 44, 45]. In 2022, the World Health Organization reported that 23% of all deaths from COPD in adults in low- and middle-income countries are due to exposure to household air pollution [46]. According to Raju et al. [41], indoor air pollution is associated with poor lung development, an increased risk of respiratory tract infections, and an increase in the prevalence and morbidity attributable to asthma and COPD. Therefore, patients should be more conscious and vigilant in monitoring these levels [34, 47]. In addition, there is a need to develop guidelines and improve the accessibility of information on pollen and pollution levels for these patients [46].

Despite extensive efforts to reduce the prevalence of COPD and the advancements in scientific knowledge in this field, there are still various areas in healthcare that require improvement. The COVID-19 pandemic has underscored the significance of individual and collective respiratory health, emphasizing the need to continue conducting research on COPD management [24]. It is essential to continuously update clinical protocols and guidelines, invest in health promotion initiatives, and enhance COPD literacy [24].

Strengths and Limitations

In the final round, a significant increase in consensus was observed. It is important to acknowledge that one of the potential limitations of the Delphi technique is the

possibility of experts feeling pressured to reach a consensus, which may hinder the true expression of their opinions. However, given the time-consuming nature of this method, it can be assumed that the participating experts had a genuine interest in the subject matter and were motivated to provide their valuable insights.

Considering that the response rate was within the recommended range, it can be inferred that the specialists' responses were a result of their authentic interest in the topic and that potential biases were minimized. Throughout the implementation of the Delphi method, the experts' comments facilitated a constructive discussion, which played a vital role in achieving consensus on numerous recommendations. Although the number of participants remained within the recommended range, it is worth noting that having a larger number of specialists would have further enriched the results and enhanced the robustness of the findings. To ensure the confidentiality and anonymity of the experts and their affiliated institutions, certain details regarding their identities were intentionally omitted from the manuscript in order to keep open and honest participation, free from external influences, judgments, or social and professional pressures.

By addressing these methodological considerations and maintaining a transparent and collaborative approach, this study has successfully generated valuable insights and recommendations from a diverse panel of experts in the field. These findings can serve as a foundation for future research, policy development, and clinical practice in COPD management.

Conclusion

This study has emphasized the critical importance of investing in respiratory health and recognizing the profound impact of COPD on patients, healthcare systems, and economies. The findings have highlighted the significance of prevention and timely treatment of exacerbations as key strategies for enhancing the management of COPD and reducing associated morbidity and mortality. Improving the coordination and integration of care across different levels, including the efficient integration of information systems and the decentralization of hospital competencies, emerged as essential factors for comprehensive COPD management.

The COVID-19 pandemic has further underscored the urgency of prioritizing actions to promote respiratory health and increase COPD literacy. It is crucial to maintain a dedicated focus on research and innovation in COPD management, constantly updating clinical standards and guidelines to ensure the most effective and up-to-date care practices.

Despite extensive efforts to decrease the prevalence of COPD, this study has revealed that there are still multiple areas where improvements can be made at all levels of care. Addressing these gaps requires continued collaboration among healthcare professionals, policymakers, and researchers to implement comprehensive strategies that encompass prevention, early detection, effective treatment, and patient education. By addressing these challenges and implementing the recommendations from this study, we can strive to improve the lives of individuals living with COPD, optimize healthcare resources, and mitigate the economic burden associated with this debilitating disease.

Author Contributions

A.R.P., B.R., H.M., and S.H. were involved in the conception and design of the study. A.R.P., A.S.C., F.D., and B.R. conducted the study, analysis, and interpretation of the results.

A.S.C., B.R., and A.R.P. wrote the first draft of the manuscript, and all authors edited, reviewed, and approved the final version of the manuscript. H.M. and S.H. reviewed the final version of the manuscript, with important contributions to the discussion.

Data Availability Statement

A.R.P. is the guarantor of this work and, as such, has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of data analysis.

References

1 Carvalheira AS. 3o Relatório do Observatório Nacional das Doenças Respiratórias: panorama das doenças respiratórias em Portugal. Lisboa: Observatório Nacional das Doenças Respiratórias; 2018.
2 OECD. European Union. Health at a glance: Europe 2022: state of health in the EU cycle. Paris: OECD Publishing; 2022.
3 OECD. European Union. Health at a Glance: Europe 2020. Health at a Glance 2020. Paris: OECD Publishing; 2020.
4 WHO. The top 10 causes of death [Internet]. Geneva: World Health Organization; 2020 [cited 2023 Feb 13]. Available from: https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death.
5 Levine SM, Marciniuk DD. Global impact of respiratory disease: what can we do, together, to make a difference? Chest. 2022;161(5):1153–4.
6 OECD. European Union. Health at a glance: Europe 2018. Paris: OECD Publishing; 2018.
7 Bárbara C, Rodrigues F, Dias H, Cardoso J, Almeida J, Matos MJ, et al. Chronic obstructive pulmonary disease prevalence in Lisbon, Portugal: the burden of obstructive lung disease study. Rev Port Pneumol. 2013;19(3):96–105.
8 Portugal. Ministério da Saúde. Direção-Geral da Saúde. Doenças respiratórias em números. Programa Nacional para as Doenças Respiratórias. Lisboa: Direção-Geral da Saúde; 2015.
9 World Health Organization. Chronic obstructive pulmonary disease (COPD) [Internet]. Geneva: World Health Organization; 2023. [cited 2023 Mar 8]. Available from: https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd).
10 Oliveira AS, Munhá J, Bugalho A, Guimarães M, Reis G, Marques A. Identification and assessment of COPD exacerbations. Pulmonology. 2018;24(1):42–7.
11 Guimarães M, Bugalho A, Oliveira AS, Moita J, Marques A; GI DPOC-Grupo de Interesse na Doença Pulmonar Obstrutiva Crónica. COPD control: can a consensus be found? Rev Port Pneumol. 2016;22(3):167–76.
12 Carneiro R, Sousa C, Pinto A, Almeida F, Oliveira JR, Rocha N. Risco de reinternamento na doença pulmonar obstrutiva crónica: estudo prospectivo com ênfase no valor da avaliação da qualidade de vida e depressão. Rev Port Pneumol. 2010;16(5):759–77.

13 Freedman N. Reducing COPD readmissions: strategies for the pulmonologist to improve outcomes. Chest. 2019;156(4):802–7.
14 Hashiguchi OT. Bringing health care to the patient: an overview of the use of telemedicine in OECD countries. Paris: OECD Publishing; 2020 (OECD Health Working Papers; 116).
15 Fernandes A. Exacerbation profile of chronic obstructive pulmonary disease patients at diagnosis. 13º congreso de Pneumologia do centro-ibérico. 46 jornadas de Actualização pneumológica, coimbra, 7-8 julho 2022. Coimbra: Associação de Estudos Respiratórios (AER); 2022.
16 López-Campos JL, Tan W, Soriano JB. Global burden of COPD. Respirology. 2016;21(1):14–23.
17 Golden Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, treatment, management, and prevention of chronic obstructive pulmonary disease: 2023 report. Chicago, IL: Global Initiative for Chronic Obstructive Lung Disease; 2022.
18 Viegi G, Maio S, Fasola S, Baldacci S. Global burden of chronic respiratory diseases. J Aerosol Med Pulm Drug Deliv. 2020;33(4):171–7.
19 Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: how to decide its appropriateness. World J Methodol. 2021;11(4):116–29.
20 McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. Int J Clin Pharm. 2016;38(3):655–62.
21 Rowe G, Wright G. The Delphi technique as a forecasting tool: issues and analysis. Int J Forecast. 1999;15(4):353–75.
22 Delbecq A, Van de Ven A, Gustafson D. Group techniques for program planning: a guide to nominal group and Delphi processes. Glenview, IL: Scott, Foresman; 1976.
23 Barrett D, Heale R. What are Delphi studies? Evid Based Nurs. 2020;23(3):68–9.
24 Hall I, Walker S, Holgate ST. Respiratory research in the UK: investing for the next 10 years. Thorax. 2022;77(9):851–3.
25 Ritchie AI, Wedzicha JA. Definition, causes, pathogenesis, and consequences of chronic obstructive pulmonary disease exacerbations. Clin Chest Med. 2020;41(3):421–38.
26 Reis AJ, Alves C, Furtado S, Ferreira J, Drummond M, Robalo-Cordeiro C, et al. COPD exacerbations: management and

hospital discharge. Pulmonology. 2018;24(6):345–50.
27 Ferreira CP, Vicente C, Castro D, Torrado D, Silva E, Mendes G, et al. Guia prático de gestão da DPOC nos cuidados de saúde primários. Madrid: Springer Healthcare Ibérica; 2021.
28 Rossaki FM, Hurst JR, van Gemert F, Kirenga BJ, Williams S, Khoo EM, et al. Strategies for the prevention, diagnosis and treatment of COPD in low- and middle- income countries: the importance of primary care. Expert Rev Respir Med. 2021;15(12):1563–77.
29 Waibel S, Vargas I, Aller MB, Gusmão R, Henao D, Vázquez ML. The performance of integrated health care networks in continuity of care: a qualitative multiple case study of COPD patients. Int J Integr Care. 2015;15(3):e029.
30 Kyaw TL, Ng N, Theocharaki M, Wennberg P, Sahlen KG. Cost-effectiveness of digital tools for behavior change interventions among people with chronic diseases: systematic review. Interact J Med Res. 2023;12:e42396.
31 Shah SA, Velardo C, Farmer A, Tarassenko L. Exacerbations in chronic obstructive pulmonary disease: identification and prediction using a digital health system. J Med Internet Res. 2017;19(3):e69.
32 Eze ND, Mateus C, Cravo Oliveira Hashiguchi T. Telemedicine in the OECD: an umbrella review of clinical and cost-effectiveness, patient experience and implementation. PLoS One. 2020;15(8):e0237585.
33 Ramachandran HJ, Oh JL, Cheong YK, Jiang Y, Teo JYC, Seah CWA, et al. Barriers and facilitators to the adoption of digital health interventions for COPD management: a scoping review. Hear Lung. 2023;59:117–27.
34 Forum of International Respiratory Societies. The global impact of respiratory disease. 3rd ed. Lausanne: European Respiratory Society; 2021.
35 Valentino AS, Eddy E, Woods Z, Wilken L. Pharmacist provided spirometry services: a scoping review. Integr Pharm Res Pract. 2021;10:93–111.
36 van der Molen T, van Boven JFM, Maguire T, Goyal P, Altman P. Optimizing identification and management of COPD patients: reviewing the role of the community pharmacist. Br J Clin Pharmacol. 2017;83(1):192–201.

37 Williams D. The role of the pharmacist in optimizing outcomes with roflumilast, a PDE4 inhibitor for the treatment of COPD. J Pharm Pract. 2022;35(3):445–54.

38 Idowu O, Makhinova T, Quintanilha M, Yuksel N, Schindel TJ, Tsuyuki RT. Experience of patients with COPD of pharmacists' provided care: a qualitative study. Pharmacy. 2021;9(3):e119.

39 Hudd TR. Emerging role of pharmacists in managing patients with chronic obstructive pulmonary disease. Am J Heal Pharm. 2020; 77(19):1625–30.

40 Hourmant B, Gobert CG, Plumet R, Lott MC, Zabbé C, Tromeur C, et al. Screening for COPD in primary care, involving dentists, pharmacists, physiotherapists, nurses and general practitioners (the UNANIME pilot study). Respir Med Res. 2021;80:e100853.

41 Raju S, Siddharthan T, McCormack MC. Indoor air pollution and respiratory health. Clin Chest Med. 2020;41(4):825–43.

42 D'Amato G, Cecchi L, D'Amato M, Annesi-Maesano I. Climate change and respiratory diseases. Eur Respir Rev. 2014;23(132):161–9.

43 Yang IA, Jenkins CR, Salvi SS. Chronic obstructive pulmonary disease in never-smokers: risk factors, pathogenesis, and implications for prevention and treatment. Lancet Respir Med. 2022;10(5):497–511.

44 Idrose NS, Lodge CJ, Erbas B, Douglass JA, Bui DS, Dharmage SC. A review of the respiratory health burden attributable to short-term exposure to pollen. Int J Environ Res Public Health. 2022;19(12):e7541.

45 Cirera L, García-Marcos L, Giménez J, Moreno-Grau S, Tobías A, Pérez-Fernández V, et al. Daily effects of air pollutants and pollen types on asthma and COPD hospital emergency visits in the industrial and Mediterranean Spanish city of Cartagena. Allergol Immunopath. 2012;40(4):231–7.

46 World Health Organization. Household air pollution [Internet]. Geneva: World Health Organization; 2022. [cited 2023 Jun 23]. Available from: https://tinyurl.com/yc6dkrpe.

47 Schraufnagel DE, Balmes JR, Cowl CT, De Matteis S, Jung SH, Mortimer K, et al. Air pollution and noncommunicable diseases: a review by the forum of international respiratory societies' environmental committee, Part 2: air pollution and organ systems. Chest. 2019;155(2):417–26.