Multidisciplinary Approaches in Chronic Obstructive Pulmonary Disease Management: Challenges, Benefits, and Future Directions

WIELODYSCYPLINARNE PODEJŚCIA W LECZENIU PRZEWLEKŁEJ OBTURACYJNEJ CHOROBY PŁUC: WYZWANIA, KORZYŚCI I KIERUNKI ROZWOJU

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Streszczenie

Przewlekła obturacyjna choroba płuc (POChP) stanowi poważne wyzwanie dla zdrowia publicznego, charakteryzujące się postępującym ograniczeniem przepływu powietrza i wysoką zachorowalnością. Podejście multidyscyplinarne (MDA) przyniosło wyraźne korzyści, poprawiając wyniki kliniczne dzięki skoordynowanej współpracy pulmonologów, pielęgniarek, farmaceutów, terapeutów oddechowych, dietetyków, fizjoterapeutów oraz specjalistów ds. pomocy psychospołecznej. Solidne dowody potwierdzają poprawę w zakresie kontroli objawów, jakości życia, wskaźników hospitalizacji i śmiertelności wynikającą z MDA, co wykazały duże badania kliniczne. Pomimo tych zalet wdrażanie MDA napotyka na poważne przeszkody, w tym nieodpowiednią komunikację, niejasne definicje ról, ograniczenia finansowe i ograniczone zasoby. Fragmentaryczna opieka często wynika z barier hierarchicznych i słabej znajomości pacjentów z większymi zespołami opieki, co skutkuje zmniejszoną satysfakcją pacjentów i niespójnym postępowaniem klinicznym. Najlepsze praktyki w zakresie skutecznej MDA kładą nacisk na ustrukturyzowane protokoły komunikacyjne, jasno zdefiniowane role w zespole oraz wczesne zaangażowanie specjalistów, co prowadzi do lepszej koordynacji i poprawy wyników. Pojawiające się dowody podkreślają potencjał sztucznej inteligencji (AI) w łagodzeniu istniejących ograniczeń MDA poprzez optymalizację dokładności diagnostycznej, przewidywanie zaostrzeń oraz usprawnienie przebiegu pracy klinicznej. Postęp w opiece nad chorymi na POChP wymaga włączenia ram MDA, wzbogaconych o narzędzia AI, do obecnego standardu opieki, co pozwoli rozwiązać .

Słowa kluczowe: przewlekła obturacyjna choroba płuc, opieka wielodyscyplinarna, zintegrowane leczenie chorób, rehabilitacja pulmonologiczna, sztuczna inteligencja, opłacalność

Summary

Chronic obstructive pulmonary disease (COPD) poses a major public health challenge, characterized by progressive airflow limitation and substantial morbidity. The multidisciplinary approach (MDA) has demonstrated clear benefits, enhancing clinical outcomes through coordinated expertise of pulmonologists, nurses, pharmacists, respiratory therapists, dietitians, physical therapists, and psychosocial specialists. Robust evidence supports MDA-driven improvements in symptom control, quality of life, hospitalization rates, and mortality, as demonstrated by major trials. Despite these advantages, implementing MDA faces significant barriers, including inadequate communication, ambiguous role definitions, financial constraints, and resource limitations. Fragmented care often arises due to hierarchical barriers and poor patient familiarity with larger care teams, resulting in diminished patient satisfaction and inconsistent clinical management. Best practices for effective MDA emphasize structured communication protocols, clearly defined team roles, and early specialist involvement, leading to enhanced coordination and improved outcomes. Emerging evidence highlights the potential of artificial intelligence (AI) in mitigating existing MDA limitations by optimizing diagnostic accuracy, predicting exacerbations, and streamlining clinical workflows. Advancing COPD care necessitates integrating MDA frameworks augmented by AI tools into the current standard of care, thus addressing current implementation challenges to optimize clinical efficacy, economic efficiency, and patient-centered outcomes.

Key words: Chronic Obstructive Pulmonary Disease, Multidisciplinary Care, Integrated Disease Management, Pulmonary Rehabilitation, Artificial Intelligence, Cost-Effectiveneness

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is marked by progressive airflow restriction and lung tissue damage, resulting from structural changes in the lungs caused by chronic inflammation leading to airway narrowing and reduced lung recoil, typically manifesting as cough, shortness of breath, and sputum production.[1] COPD may result in conditions such as pneumonia, hypercapnia, hypoxemia, respiratory failure, pulmonary hypertension, right-sided heart failure, pneumothorax, and polycythemia due to excessive red blood cell production, and subsequently, even death. [2] The risk of COPD is primarily linked to long-term cigarette smoking, but factors such as secondhand smoke, asthma, occupational exposure to irritants, fumes from burning fuel in poorly ventilated homes, and genetic factors like AAT deficiency (especially when combined with smoking) can also contribute to its development.[3]

The National Heart, Lung, and Blood Institute (NHLBI) estimated that there were 14.8 million people with physician-diagnosed COPD and *'many more'* with undiagnosed COPD in the U.S itself.[4] The prevalence of COPD is further expected to increase, with global cases among individuals aged 25 and older projected to rise by 23% between 2020 and 2050, nearing 600 million. By 2050, the number of female cases is expected to surge by 47.1%, compared to a 9.4% increase in males, while cases in low- and middle-income regions are predicted to more than double those in high-income areas.[5] In the U.S., COPD results in 15.4 million physician visits, 1.5 million emergency department (ED) visits, and 726,000 hospitalizations each year. The worldwide unadjusted annual death rate for COPD in 2008 was 45.3 per 100,000 population. COPD has yet another significant impact; its financial implications. A study of the financial burden of COPD in the US by Ford et al.,[6] provided estimates from 2010 to 2019 COPD-attributable costs, and estimated a burden of $10.7 billion in 2019 (in 2012 US dollars). However, a newer study by Mannino et al.,[7] estimated COPD-attributable costs to be $31.3 billion in 2019, and further estimated it to double to $60.5 billion in 2029; this difference was attributed to their methodology, which involved using state-specific prevalence rates of COPD instead of regional data. Living with COPD can significantly affect physical, mental, and emotional domains of health related quality of life (HRQoL).[8] COPD greatly reduces quality of life, with increased severity linked to higher symptom burden, diminished function, and greater psychosocial distress, effects that intensify with age but can also deeply impact younger patients due to early limitations.[9] The Multidisciplinary Approach (MDA) is a patient-centered model where professionals from multiple specialties collaborate in real-time to deliver integrated care.[10] Baldwin traced the origins of interdisciplinary healthcare in the U.S. to the effective use of multidisciplinary medical teams during World War II, which inspired its modern development.[11]

Multidisciplinary approach reduces patient mortality, complications, length of stay, and readmissions; enhances patient satisfaction; and leads to increased use of ancillary services like physical therapy and nutritional services.[12] They also enhance communication between different healthcare disciplines, lessen near-miss events and errors, and lessen barriers that stand between patients, healthcare providers, and their families. Over the years, the MDTA has been successfully applied to several areas in medical care, including cancer care [13], such as palliative care, wound care, and geriatrics.[14-16]

Barriers like low patient health literacy and complex treatment regimens further hinder the success of multidisciplinary care, ultimately impacting patient outcomes and quality of life. This review aims to look at the current challenges in the multidisciplinary approach in COPD management and recommend the best practices for its further integration in patient care.

Improved Outcomes with MDA

There have been numerous studies that have conclusively demonstrated the direct benefits of a multidisciplinary approach to the management of COPD patients. A meta-analysis by Kruis et al of over 26 studies concluded that integrated disease management including multidisciplinary approach to treatment led to better patient outcomes including improved exercise capacity, improvement in lung function tests as assessed by the six minutes' walk test wherein patients on MDA had clinically significant improvement as compared to controls at 12 months follow up (95% CI 21.83 to 65.89; $P < 0.001$). There was also a decrease in episodes of acute exacerbation of COPD (MD -3.78 days; 95% CI -5.90 to -1.67, $P < 0.001$) and an overall improvement in the patients' quality of life.[17]

In another study, McCarthy et al determined that patients who received physical rehabilitation, a vital component of MDA along with the standard COPD care, had statistically significant improvement in all clinical outcomes being evaluated. In four important domains of QoL (Chronic Respiratory Questionnaire (CRQ) scores for dyspnoea, fatigue, emotional function and mastery), the effect was larger than the minimal clinically important difference (MCID) of 0.5 units while in the St. George's Respiratory Questionnaire (SGRQ), the authors noted an improvement in the total score to better than 4 units which was statistically significant (MD -6.89, 95% CI -9.26 to -4.52; N = 1146; studies = 19; low-quality evidence).[18] Similar findings were demonstrated in a 2021 meta-analysis (that included these earlier reviews as well) by Poot et al; with improvement in disease specific QOL, exercise capacity, hospital admissions and hospital days per person. However, it did not find any statistical difference between mortality, duration of antibiotic therapy or dyspnoea, depression, anxiety scores between patients in the MDA group and those receiving usual care.[19]

In the COPD Patient Management European Trial (COMET) 2017, in 319 participants, it was found that patients receiving integrated disease management (IDM) care, which included a self-management program, home telemonitoring, care coordination, and medical management, demonstrated better clinical outcomes compared to those receiving usual care. Although the primary endpoint, unplanned all-cause hospitalisation days per year in the intention-to-treat (ITT) population did not show a statistically significant difference between groups (17.4 ± 35.4 vs. 22.6 ± 41.8 days; mean difference -5.3, 95% CI -13.7 to -3.1; p=0.16), the IDM group experienced significantly fewer acute care hospitalisation days (p=0.047), a lower BODE index (p=0.01), and a markedly reduced mortality rate (1.9% vs. 14.2%; p<0.001). There was no significant difference in the frequency of exacerbations[20]

The PIC COPD trial, a two-centre RCT involving 470 patients with COPD and ≥2 comorbidities, evaluated a

case manager-led care model. Though total ED visits and hospitalisations were similar, the intervention group showed reduced risk of ED presentation (RR 0.74), hospitalisation (RR 0.69), and lower mortality (21 vs. 36 deaths; HR 0.56).[21,22]

In a year-long RCT (n=180), high-risk COPD patients receiving multidisciplinary assessment (MDA) showed significant improvement in CAT scores (22.6 to 14.8) versus usual care (19.3 to 22.0), with an adjusted difference of 9.3 ($p<0.001$). The MDA group also had fewer severe exacerbations (-48.9%), urgent primary care visits (-30.2%), and ED visits (-23.6%). Supporting evidence from a prospective Israeli cohort (n=154) using a "one-stop" multidisciplinary clinic showed gains in FEV_1 (1.38 L to 1.47 L), CAT score (21.3 to 16.5), 6MWD (+42 m), and smoking reduction (53% to 21%). These reinforce benefits of structured COPD management.[23] Economic evaluations reinforce the cost-effectiveness of multidisciplinary COPD care models. A systematic review and meta-analysis of 11 studies reported that COPD disease management (COPD-DM) programs reduced hospitalization costs by €1060 (95% CI: €2040 to €80) and total healthcare utilization costs by €898 (95% CI: €1566 to €231) per patient annually, with a modest improvement in health-related quality of life, such as a 1.7-point reduction in the St George's Respiratory Questionnaire (SGRQ) score (95% CI: 0.5–2.9).[24] Similarly, a cost-effectiveness analysis of an integrated care model (ICM) in advanced COPD patients demonstrated significant reductions in ambulatory visits ($p=0.037$), emergency department use, and hospitalizations ($p=0.033$), with favorable incremental cost-effectiveness ratios for avoiding hospitalizations (−€227), exacerbation-related admissions (−€312), and emergency procedures (−€119).[25] A cost-utility analysis of an integrated disease management (IDM) program for high-risk, exacerbation-prone COPD patients showed that IDM was dominant over usual care, delivering both cost savings and improved outcomes. The intervention resulted in a net monetary benefit of $5360 (95% CI: $5175–$5546) per patient per year, with higher QALYs and lower overall costs compared to standard care.[26]

Components of the Multidisciplinary Team (MDT)

A Multidisciplinary Team (MDT) consists of a variety of healthcare professionals from different specialties who collaborate to develop and evaluate treatment plans for patients. This approach improves communication among disciplines, ensuring that all potential treatment options and modalities are thoroughly considered and considers the patient's individual preferences and specific supportive care needs.[27] The MDT works collaboratively to enhance physical, emotional, and social well-being, improve disease management, boost quality of life, and minimize hospital admissions.[28]

Physicians, particularly primary care providers (PCPs), are the centerpiece of any effective multidisciplinary team managing COPD. They oversee routine care, symptom control, prevention, and monitoring, with most patients (nearly 90%) seeking their care for ambulatory visits.[29] However, early involvement of specialists such as pulmonologists and cardiologists can be essential for optimizing outcomes. Pulmonologists bring critical expertise in confirming diagnosis through spirometry, imaging, and bronchoscopic evaluation, and in tailoring individualized treatment plans that incorporate pharmacologic therapy, pulmonary rehabilitation, and advanced interventions when needed.[30] Their early involvement has also been shown to improve treatment adherence and survival in patients with COPD and comorbid conditions such as lung cancer.[31]

Depression affects over one-third of COPD patients globally, with female sex, advanced disease stage, dyspnea, and impaired quality of life being significant risk factors.[32] Psychiatric comorbidities like depression and anxiety not only worsen clinical outcomes but also increase the risk of exacerbations and hospital readmissions.[33] Chaplaincy support can benefit COPD patients with mental health needs. Daily hospital visits by chaplains have been linked to reduced anxiety, shorter stays, and greater care satisfaction.[34] In home care, regular visits from clergy or religious community members are associated with lower depression rates in seriously ill patients, including those with advanced COPD.[35]

Nurses are indispensable members of the multidisciplinary team managing COPD, providing a broad range of services that directly impact patient outcomes. A systematic review by Aranburu-Imatz et al. demonstrated that nurse-led management significantly improved patients' quality of life, emotional well-being, and pulmonary function, while reducing hospitalizations and emergency department visits.[36] Similarly, a territory-wide cohort study from Hong Kong revealed that participation in a nurse- and allied health–led respiratory clinic was associated with substantial reductions in all-cause mortality, respiratory and cardiovascular mortality, as well as decreased healthcare service utilization.[37]

Respiratory therapists (RTs) play a critical role in COPD care, managing oxygen therapy, noninvasive ventilation (NIV), and monitoring gas exchange. Their involvement ensures accurate, timely interventions during exacerbations. A quasi-randomized study by Kollef et al. showed that RCP-directed protocols reduced discordant care orders, unnecessary treatments, and overall costs without added risk.[38] RT-led management of oxygen and NIV is also linked to better outcomes, including reduced need for invasive ventilation in COPD exacerbations.[39] Physical therapy interventions, including aerobic exercises, strength training, and breathing strategies like pursed-lip and diaphragmatic breathing, have been shown to enhance exercise tolerance, reduce dyspnea, and improve quality of life.[40] A systematic review and meta-analysis of nineteen randomized controlled trials demonstrated that pulmonary rehabilitation programs, a key area of PT-led intervention, produced significant improvements in COPD patients' quality of life, as reflected by meaningful reductions in St. George's Respiratory Questionnaire scores.[41]

Dietitians involvement becomes especially crucial during exacerbations, where targeted nutritional support can aid recovery and improve patient resilience. Evidence suggests that tailored dietary counseling can significantly enhance dietary intake, improve nutritional status, strengthen respiratory muscles, and elevate quality of life in COPD patients.[42] A recent systematic review confirmed that incorporating nutritional interventions within pulmonary rehabilitation programs is associated with improved functional and quality of life outcomes, further supporting the inclusion of dietitians in COPD multidisciplinary teams.[43]

Pharmacists active participation in clinical teams has been shown to enhance patient care; Miller et al. demonstrated that pharmacists in rounds made significantly more timely and accepted medication interventions compared to those conducting routine ward

visits, leading to better medication safety and fewer prescribing errors.[44,45] Similarly, the pharmacist-hospitalist collaborative (PHC) model has been associated with reduced hospital LoS, suggesting that pharmacist integration into direct care can improve healthcare efficiency.[46] An observational study by Moradkhani et al. found that better quality of life and health status were associated with improved medication adherence, while polypharmacy had a detrimental effect, reinforcing the need for pharmacist involvement in simplifying regimens and supporting compliance.[47]

Social workers help mitigate social frailty, a condition affecting over one-third of COPD patients and linked directly to increased dyspnea, reduced appetite, severe exacerbations, and unexpected hospitalizations.[48] They facilitate stronger social support networks, alleviate loneliness, which also affects nearly a third of COPD patients, and reduce associated risks of depression and poor clinical outcomes, including frequent hospital admissions and poorer rehabilitation response.[49] Counselors complement these efforts by detecting psychological distress through validated tools (GHQ-12) and providing targeted interventions, such as motivational interviewing (MI). Robust evidence shows that MI significantly improves patient self-efficacy, emotional health, quality of life, and notably, reduces COPD-related hospital admissions.[50] Figure shows the proposed composition of a multidisciplinary team for COPD patients: (Fig. 1)

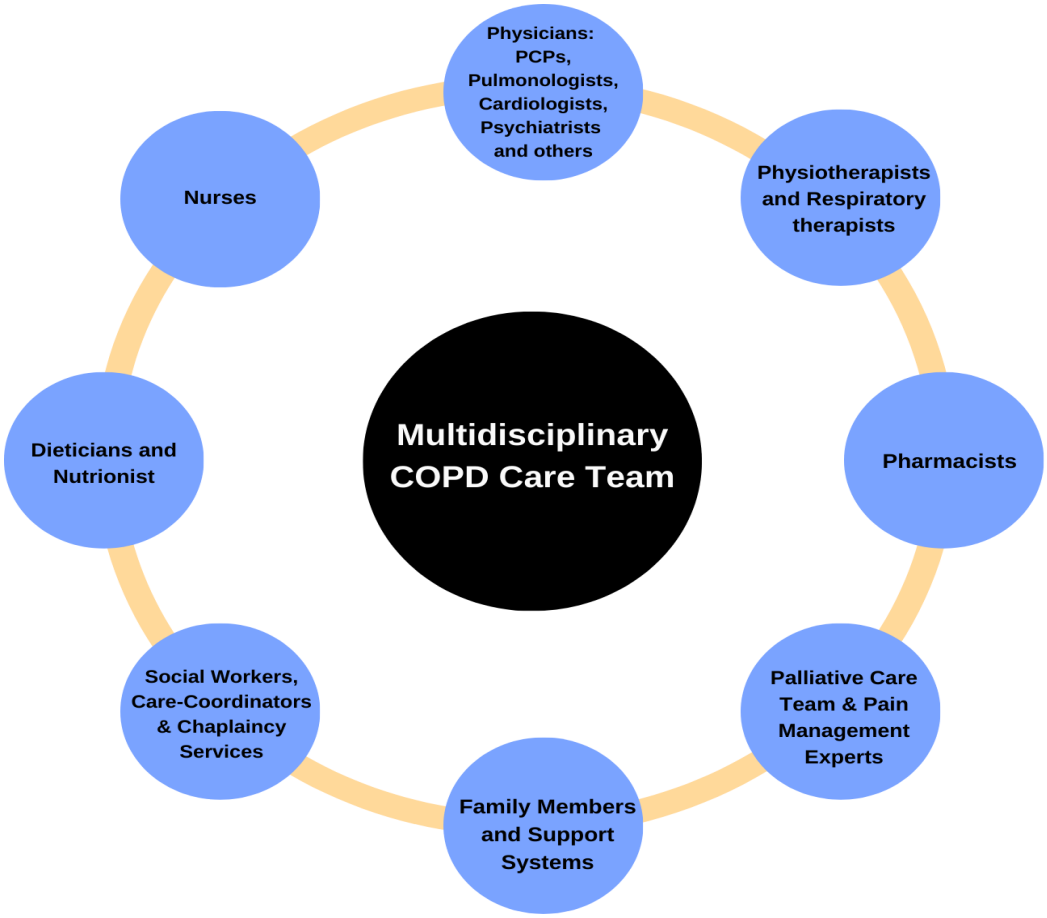

Figure 1. Different Components of an all-rounded Multidisciplinary COPD Care Team

Challenges to MDT

A key challenge is consistent attendance by all the members of the team, which poses a significant time barrier, impacting the workflow and distribution of human resources.[51] This affects the existing workload of the team members and may result in decreased efficiency in workplaces where time and resources are limited. Furthermore, breaks in communication between the different members of the team may result in ineffective collaboration and even potential confrontations.[52]

An interview study exploring the views of surgeons, oncologists, nurses, and administrators on various characteristics of MDMs found that patient discussions do not encompass the contributions of different disciplines equally, surgeons, who dominate

discussion, are biased toward biomedical information.[53] In other instances, the dominance of physicians during patient rounds may lead to hesitation to voice opinions by other non-physician members, especially nurses.[54]

Another hurdle is anxiety, it may hamper clinical history and examination, affecting the diagnosis and treatment of the patient. Communication between the multidisciplinary team and families was also evaluated in a qualitative study, which demonstrated frustration with delays and repeated conversations with different staff.[55]

Some studies have shown the effectiveness of a multidisciplinary approach in reducing the costs across a spectrum of problems, the overall evidence has been inconclusive given the heterogeneity of the outcomes.[56] It is also worth noting that this cost effectiveness could be a function of the volume of patients cared for, and the time, as seen in multidisciplinary healthcare (MHC) model implementation for diabetes patients. Increasing the number of patients managed per unit was associated with earlier cost-effectiveness and long-term savings.[57]

A crucial barrier to MDT implementation is the lack of standardized protocols that guide the overall management.[58] A study by Bailey et al elucidated that the mere placement of nurse practitioners and family physicians in a common clinical practice without some form of orientation process does not produce collaborative practice.[59]

Best Practices for MDT

The best practices for MDT care in their truest sense focus on decreasing friction and increasing the efficiency of the team. To address the time demands of multidisciplinary rounds and improve communication, structured checklists have proven effective. They help standardize care, reduce errors, and minimize omissions.[60] A systematic review and meta-analysis by MacKinnon et al. found that ICU rounding checklists were associated with a 20% reduction in in-hospital mortality (RR 0.80; 95% CI, 0.70-0.92). Additional benefits included reductions in ICU and 30-day mortality, hospital length of stay, and rates of infections.[61] The actual sequence of communication, however, is dynamic and depends on the unique patient-specific scenario.

Effective communication must be ensured that during rounds and didactics, no team member's concerns must be left unaddressed or disregarded. This is especially true in the case of family members; in a pathology like COPD, where exacerbations can lead to prolonged and sometimes frequent ICU admissions, effective communication can bring down costs, reduce the risk of developing intensive care syndrome post-discharge, reduce patient stress and anxiety, and improve overall satisfaction. Early involvement of specialists and palliative care consultation in the course of chronic diseases leads to improved outcomes in terms of QoL and survival.[62]

Future Directions

Some of the challenges could be potentially addressed by the use of Artificial Intelligence (AI); it has the potential to support COPD care across several domains.In a multicenter study, AI correctly diagnosed 82% of respiratory cases by accurately interpreting the PFTs, thus substantially outperforming pulmonologists, who achieved 44.6% accuracy with significant interobserver variability.[63] Mobile platforms like the Espiro app have shown near-perfect agreement with pulmonologists in spirometry interpretation, with sensitivity and specificity exceeding 97%,[64] suggesting real-world utility in primary care and resource-limited settings. Future care models have shown diagnostic accuracies up to 95%, outperforming both decision trees and clinicians.[65] Algorithms incorporating chest radiographs and clinical data have achieved AUCs as high as 0.969 for COPD detection and 0.894 for severity grading,[66] potentially enabling early screening with minimal radiation exposure.

Conclusion

COPD remains a leading cause of death globally. A multidisciplinary team approach unites healthcare professionals from various fields to collaboratively plan and deliver care, enhancing communication and ensuring comprehensive treatment. While this model improves outcomes, it also presents challenges, including professional hierarchies, differing opinions, and privacy concerns. Effective implementation requires clear protocols, strong leadership, and defined roles. Integrating AI could further support timely, cost-effective multidisciplinary care.

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Potential Conflicts of Interest

The authors declare that there are no financial or personal relationships that could be perceived to influence the work reported in this manuscript.

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