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ORIGINAL RESEARCH

COPD Action Plans: Gaps in Development Methods, Content, and Format

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Purpose: COPD action plans (APs) are integral to self-management and recommended across clinical practice guidelines, but primary care provider and patient usage remain low. Given that uptake is influenced by content, format, and development methods, we sought to collect a broad sample of existing COPD APs and to analyze these characteristics.

Materials and Methods: We collected English language COPD APs from: 1) an internet search; 2) international COPD guidelines; 3) pulmonary/COPD organizations and experts; and 4) published randomized controlled trials (RCTs) evaluating COPD APs. For each AP, we described background information, development methods and any available evaluation data. We used guideline-based and inductively-derived criteria for AP content analysis. For format analysis, we applied recognized evidence-based formatting standards for printed educational material. We also calculated the Flesch-Kincaid readability scores.

Results: We identified 63 unique COPD APs from seven countries. Information on the development methods was available in only seven (11%) APs, and only one included patients in development. 4/58 (7%) APs identified from sources other than RCTs had been formally evaluated (all as part of larger complex interventions). In AP content, we found inconsistency in definitions for the action point requiring treatment, in treatment instructions (eg medication options, doses, and duration), and in lifestyle/behavior change cues. Formatting across APs was also variable, and APs met a mean of only 5.4 ± 1.2 out of 8 core formatting principles for printed education material design. The average Flesch-Kincaid grade level was 6.5 ± 1.6.

Conclusion: COPD APs are recommended across guidelines but are seldom implemented. Our novel analysis of internationally available COPD APs reveals that there are several intrinsic factors related to their development, evaluation, content, and format that may be contributing to this care gap. A uniform user preference-based COPD AP with expert consensus on content, and with usability/format optimization should be developed and evaluated.

Keywords: chronic obstructive pulmonary disease, self-management, action plan, exacerbation

Introduction

The global prevalence of chronic obstructive pulmonary disease (COPD) is estimated at more than 380 million persons,[1] and COPD-related healthcare costs in the United States are projected to reach $40 billion per year in the next 20 years.[2,3] COPD exacerbations account for 35–45% of these costs,[4] and are one of the most common causes of medical hospitalization in the US.[5]

Self-management is an essential component of effective disease management, and should include a COPD exacerbation action plan (AP).[6,7] These plans provide patients with individualized, written guidance describing when and how to act when their symptoms worsen, in order to mitigate the impact of exacerbations.[6,8] They may also contain advice on lifestyle, and behavioral cues prompting increased physical activity and weight management. This component may have even greater benefit since the COVID-19 pandemic, given the population burden of long COVID and its association with

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inactivity and weight gain (particularly in women).[9] In a Cochrane review, COPD APs delivered with brief education significantly improved health-related quality of life and reduced emergency department (ED) and hospital use, with a number needed to treat of 19 to reduce one hospital admission over 12 months.[8] However, despite this compelling evidence and strong guideline recommendations,[10] practice audits have suggested that only one in three primary care providers routinely offer COPD action plans.[11] Additionally, most patients are unaware of self-management principles[12] and those with a COPD AP only adhere to it during 40% of exacerbations.[13]

Several provider- and patient-levels barriers may contribute to the underuse of COPD APs. Suboptimal formatting may impact usability, affecting both providers who must complete APs and patients who must follow them.[14] Inconsistent content and medical directives across different COPD APs available in practice may also undermine provider confidence.[15] Providers in primary care (where most patients with COPD are managed) often also lack the knowledge, confidence ("self-efficacy") and/or time required to complete and deliver COPD APs effectively.[14,15] Furthermore, APs may not be designed to account for varying levels of health literacy and numeracy among patients, which may affect their ability to confidently complete required action plan tasks.[16] This is compounded by the fact that respiratory care providers often overestimate their patients' health literacy.[17]

To address these barriers, COPD APs should feature standardized templates with evidence-based content, use formatting that optimizes usability both for primary care providers and patients, be developed through participatory methods, and accommodate low literacy and numeracy levels, However, little is known about the content, format, and methods used to develop COPD APs that are currently in use. We sought to collect and analyze existing COPD APs for these important features.

Materials and Methods

This study did not require institutional review board approval as it did not involve human subjects.

COPD Action Plan Search

We first aimed to collect currently used, recommended, or previously studied COPD APs. We defined a COPD AP as a written plan with individualized management instructions for an acute exacerbation.[8] We included COPD APs if they were in English and designed for outpatient use.

Sources

Internet Search

We started by performing *Google*™ internet searches with the terms "COPD action plan", "COPD exacerbation action plan" and "COPD flare-up action plan" on July 3, 2025. We downloaded available COPD APs from each identified link/website, ensuring that any identified AP was associated with a clinical, not-for-profit, or public group/organization. Our pre-defined saturation criterion was five consecutive links featuring COPD APs that did not introduce new variations in format or content.

International Guidelines

Next, we reviewed the most current major national COPD guidelines from respiratory organizations in jurisdictions with populations similar to Canada, along with international COPD guidelines. We searched for any additional COPD APs that were either included or recommended in the guidance document or on the corresponding organizational website. This included COPD guidelines from the following seven organizations: the Canadian Thoracic Society (Canada);[18] the American College of Physicians, American College of Chest Physicians, American Thoracic Society (United States);[19] the European Respiratory Society (Europe);[20] the National Institute for Health and Care Excellence (NICE) (United Kingdom);[21] Lung Foundation Australia (Australia);[22] the Asthma + Respiratory Foundation New Zealand (New Zealand);[23] and the Global Initiative for Chronic Obstructive Lung Disease (GOLD) (International).[24] In cases where guidelines did not include or specifically recommend a COPD AP, we contacted the author organization(s), explained the purpose of the study, and requested that a call to share any COPD APs in use or recommended for use go out to COPD experts within the organization.

Organizations and Experts

We also identified any other not-for-profit and/or patient organizations focused on COPD in the above-mentioned jurisdictions, and searched for any COPD APs provided or recommended on their websites. This included the following six organizations: COPD Canada (Canada), Canadian Lung Association (Canada), Living Well with COPD (Canada); American Lung Association (United States); Asthma + Lung UK (United Kingdom); and Lung Foundation New Zealand (New Zealand). In cases where the organization did not provide or recommend a COPD AP online, we contacted the organization and requested any recommended COPD APs.

Published Trials Including COPD APs

In a Cochrane Review, Schrijver et al reviewed randomized controlled trials (RCTs) and cluster RCTs evaluating the effectiveness of COPD self-management interventions compared to usual care.[7] They identified 26 studies involving COPD self-management interventions, from 1995 to 2020. For those interventions that included a COPD AP, we reviewed full-text articles and their appendices to retrieve the COPD AP, if available. Applying identical search terms and databases, we then updated the search for any new publications between January 1, 2020 and July 3, 2025 and similarly retrieved any available COPD APs. Where the COPD AP was not provided, we requested it from the corresponding author by e-mail. We also reviewed the references in all included studies to identify reviews and/or additional individual studies which might provide new COPD APs.

COPD Action Plan Analysis

Details, Development Methods, and Evaluation Data

We sought to identify the country of origin, release date, any available information about how the AP had been developed, and any evaluation data, for each included AP.

We sought any information on AP development methods and/or evaluation of individual APs within the APs themselves, through an additional Google search using the name of the AP, and in the original source from which the AP was identified, as follows: for APs identified through the internet search, we reviewed the website in which the AP was found; for APs identified through guidelines, we reviewed the corresponding guideline and all references; for APs linked to an organization (including in cases where the AP was identified in an organizational guideline), we examined the organization's website; and for APs identified in a published RCT, we reviewed the corresponding publication (which, by definition, would constitute evaluation data), as well as any supplementary data and references.

Content and Format Analysis

We derived initial criteria for analysis of the content and format of COPD APs based on any available explicit guidance provided in identified guidelines (see Sources, above). Two assessors (IY, RT) then inductively refined and enhanced these analytic criteria and the response categories within each criterion through serial examination of the APs, using principles of content analysis. For format analysis, we further evaluated each AP in reference to 8 commonly applied evidence-based formatting standards which have been shown to influence the visual appeal, uptake, and effectiveness of printed educational materials (see Results).[25] Any additional content and format features which fell outside of these criteria were described qualitatively. For all content/format analyses, assessors independently analyzed a random sample of six COPD APs and compared extracted data for consistency. After resolving any discrepancies with the help of a 3rd party (SG) to ensure consistent data definitions, each assessor independently assessed half of the remaining APs. One assessor then verified data consistency across all APs after full data extraction was complete. We used descriptive statistics (means, frequencies and percentages) to summarize action plan characteristics.

We calculated the Flesch-Kincaid readability scores[26] for each identified AP using an online Flesch-Kincaid calculator (https://goodcalculators.com/flesch-kincaid-calculator), by entering all content within the first action point (a point or "zone" indicating when to change treatment) from each AP into the calculator (any formatting errors created through copying and pasting were corrected before calculation).

We compared readability (Flesch-Kincaid grade level and reading ease score), as well as format (as a proportion of the 8 evidence-based formatting standards) according to whether APs had published evaluation data, their year of release

(2020 or later vs prior), and country of origin (US, UK, Canada, Australia, other). We used Welch's *t*-tests for two-group comparisons and one-way ANOVA for multi-group comparisons.

Results

COPD Action Plan Search (Figure 1)

Internet Search

Through the internet search, we retrieved 57 unique English language COPD APs fulfilling inclusion criteria. Saturation was reached at 363 web links on the *Google*™ internet Search.

Guidelines

We collected 7 APs national and international guidelines, of which 6 had previously been identified in the internet search, leaving 1 additional unique new AP.

Organizations and Experts

All six included not-for-profit and/or patient organizations provided an AP on their website, all of which had previously been identified in the internet search.

Published Trials Including COPD APs

Twenty-two of 26 (85%) studies identified by Schrijver, et al[7] referenced COPD APs that fulfilled our inclusion criteria. Nine (41%) included APs in the published manuscript or supplementary materials. Five out of the 9 (55%) had previously been identified in the internet search, leaving 4 new original APs.[27–30] We contacted corresponding authors of the remaining 13 studies and received replies from 4 (31%) authors. Two did not meet our inclusion criteria and 1 had previously been identified in the internet search, leaving one new original AP.[31]

Our updated literature search identified 48 new citations, of which one (2.1%) met inclusion criteria after abstract and full text screening.[32] We contacted the corresponding author, who indicated that their study had used the American Lung Association AP[32] (which had been previously identified in internet and organizational searches).

Overall, we accounted for 14 out of 23 (61%) APs from published studies. Seven of 14 (50%) were duplicates of APs identified in earlier searches and 2 were not applicable (14%), leaving 5 unique APs recovered from published RCTs.

Adding up the four search strategies, we recovered 63 unique COPD APs for analysis. Further details are provided in the Supplementary Data.

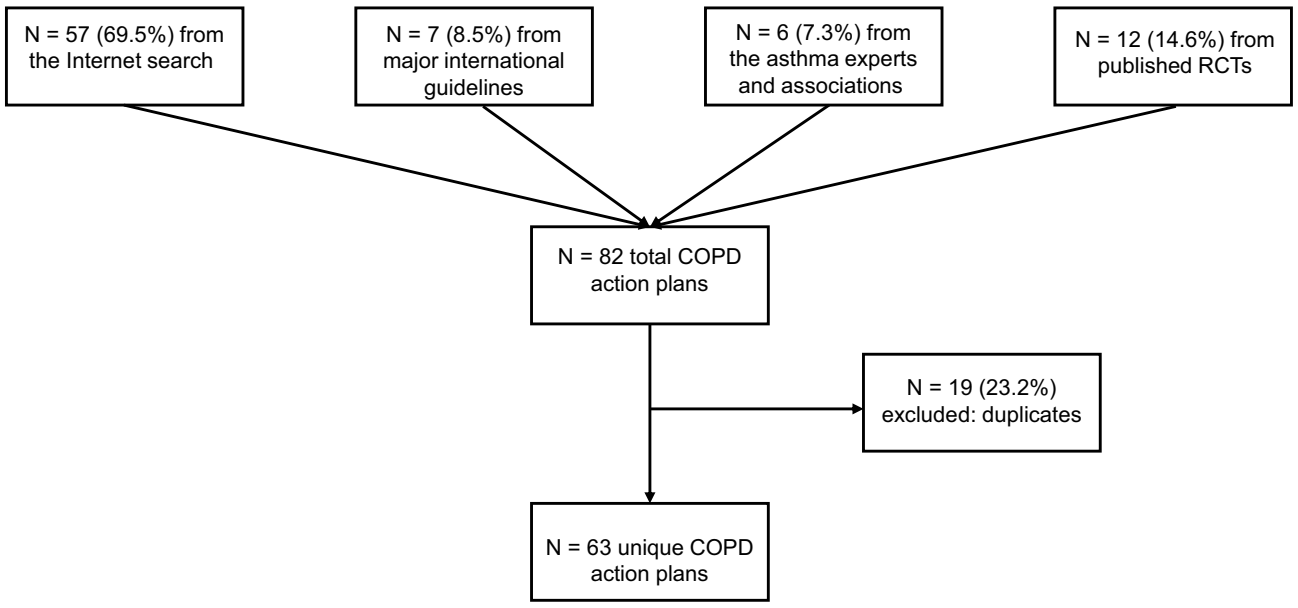

Figure 1 COPD action plan search results, by search strategy.

COPD Action Plan Analysis

Action Plan Characteristics (Table 1)

Of the 63 identified APs, 20 (32%) were from the United States (US), 19 (30%) from the United Kingdom (UK), 12 (19%) from Canada, 7 (11%) from Australia, and 5 (8%) from other jurisdictions. Nine (14%) had been developed in 2015 or earlier, 37 had been developed after 2015 (59%), and 17 (27%) were undated.

Action Plan Development Processes (Table 1)

There were no dedicated publications describing development of any of the identified APs. However, we were able to find information about AP development for 7/63 (11%) APs. The AP used in the COPE-III study (COPD study at Department of Pulmonology Enschede) by Lenferink, et al[27] was a symptom-based AP that had been developed and iterated through the COPE studies (COPE-I, COPE-II, and COPE-III) with the help of "disease experts", and refined based on patient feedback.[33,34] The 2012 "My COPD Action Plan" from the Canadian Thoracic Society (CTS) was developed with the COPD & Asthma Network of Alberta based on a former (2008) CTS AP which had contributions

Table 1 Distribution of COPD Action Plan (AP) Baseline Characteristics (n=63)

Characteristic	N (%)
Country of origin	
USA	20/63 (32%)
UK	19/63 (30%)
Canada	12/63 (19%)
Australia	7/63 (11%)
Ireland	2/63 (3%)
Netherlands and Australia	1/63 (2%)
New Zealand	1/63 (2%)
Germany	1/63 (2%)
Year of release	
2006-2010	2/63 (3%)
2011-2015	7/63 (11%)
2016-2020	17/63 (27%)
2021-2025	20/63 (32%)
Not indicated	17/63 (27%)
AP development methods information[a]	
Available	7/63 (11%)
Unavailable	56/63 (89%)
AP development stakeholder information[a]	
Available	5/63 (8%)
Disease experts with patient feedback	1/63 (2%)
2 pulmonologists, 2 family physicians	1/63 (2%)
2 physicians	2/63 (3%)
1 family physician	1/63 (2%)
Unavailable	58/63 (92%)
Published AP evaluation[a,b]	
Yes	4/58 (7%)
No	54/58 (93%)

Notes: [a] We extracted information on AP development methods and/or evaluation data from details and/or references within the AP, on the internet, and in the original source from which the AP was identified. [b] Among 58 unique APs identified in the internet, guideline, or organizational searches.

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from Living well with COPD (a not-for-profit patient and provider support organization) and had been collaboratively developed by two pulmonologists and two family physicians who in turn adapted a previous AP from the Family Physician Airways Group of Canada (FPAGC) (a respiratory-focused primary care interest group in Canada.[35] The "COPD Action Plan" from Lung Foundation Australia adapted a previous (unnamed) AP that had been developed by two physicians.[36] The "COPD Action Plan" from NHS Western Isles was written by one general practitioner.[37] The "COPD Flare Up Plan" from Vancouver Coastal Health was adapted from the Canadian Lung Association AP.[38,39] The "COPD Action Plan" from Providence Health Care Vancouver was adapted from a local community care program called the "Breathe Well British Columbia Interior Health Community Care Program".[40] The AP used in the study by Johnson-Warrington et al was adapted from The Lung Foundation Australia AP.[31]

Action Plan Evaluation Data (Table 1 and Supplementary Data)

Among 58 unique APs identified in the internet, guideline, or organizational searches, we found published evaluation data for four (7%). The Living Well with COPD (LWWCOPD) AP[41] was the best studied, with several RCTs having incorporated it in more complex self-management interventions. The Queensland Health COPD AP and Lung Health Foundation Australia AP were studied as part of a self-management program with weekly group sessions.[42] The American Lung Association AP was incorporated in a community health worker-delivered self-management program.[32] Among the RCTs associated with the five unique APs identified in the updated RCT search, all trials also incorporated the AP in a larger intervention. Further details are provided in the Supplementary Data.

Action Plan Content and Format Analysis (Tables 2–6)

Content and Format Recommendations From COPD Guidelines

Out of seven clinical practice guidelines, only two provided specific recommendations for AP content, and none provided recommendations for formatting. Regarding content, the NICE guideline provided the following suggested AP recommendations in response to COPD exacerbation: adjusting short-acting bronchodilator (SABD) therapy, starting a short course of oral corticosteroids if breathlessness interferes with activities of daily living, adding an oral antibiotic if sputum changes color and increases in volume or thickness, and/or notifying their healthcare provider.[21] The Asthma and Respiratory Foundation of New Zealand guideline suggested possible inclusion of prednisone and antibiotics in the AP, along with an unspecified timeframe for clinical review after initiation of these medications.[23]

Table 2 Descriptors Used to Define Action Points in COPD Action Plans (Found in ≥ 5 COPD Action Plans)

Action plan zone	Dyspnea, Cough, Sputum Descriptors	N (%)	Other Descriptors	N (%)
Stable baseline state	Usual activity and exercise level	43/63 (68%)	Sleeping well or a normal amount	25/63 (40%)
	Usual amount of sputum	42/63 (67%)	Normal appetite	18/63 (29%)
	Usual amounts of cough	29/63 (46%)	No or usual swollen ankles	5/63 (8%)
	Usual sputum color	21/63 (33%)		
1st action point*	Increased dyspnea	62/63 (98%)	Increased use of quick-relief inhaler/nebulizer	28/63 (44%)
	Increased sputum volume	55/63 (87%)	Difficulty sleeping	24/63 (38%)
	Change in sputum purulence and/or color	54/63 (86%)	Poor appetite	21/63 (33%)
	Changes in sputum color	49/63 (78%)	Fatigue or feeling tired/lethargic	18/63 (29%)
	Increased coughing	43/63 (68%)	Wheeze	13/63 (21%)
	Increased sputum purulence	33/63 (52%)	No response to medications	12/63 (19%)
	Exercise intolerance	28/63 (44%)	Signs of fever	11/63 (17%)
			Chest tightness	7/63 (11%)

(*Continued*)

Table 2 (Continued).

Action plan zone	Dyspnea, Cough, Sputum Descriptors	N (%)	Other Descriptors	N (%)
Last action point*	Severe shortness of breath even at rest	37/63 (59%)	Impaired level of consciousness	51/63 (81%)
	Severe exercise intolerance that interferes with activities of daily living	15/63 (24%)	Chest pain	36/63 (57%)
			Fever or shaking chills	31/63 (49%)
			Blood in sputum	18/63 (29%)
			Worsening peripheral edema	14/63 (22%)
			No relief from medications	13/63 (21%)
			Cannot sleep or woken easily	12/63 (19%)
			Symptoms have not improved in…	7/63 (11%)
			• 48 hours	4/63 (6%)
			• 2 days	1/63 (2%)
			• ___ days	1/63 (2%)
			• Not specified	1/63 (2%)

Note: *A point or "zone" indicating when to change treatment; for plans with only one action point, descriptors were included in the "1st action point" category.

Content Analysis

We divided AP content analysis into three components: 1) descriptors used to define each action point; 2) treatment recommendations provided in corresponding action point; and 3) other action plan content.

In defining action points (Table 2), the stable baseline state was described as "usual activity and exercise level" and as "usual amount of sputum" in 43/63 plans (68%) and 42/63 plans (67%). In terms of Anthonisen's criteria,[43] 62/63 (98%) included (1) "increased dyspnea" at the first action point; 55/63 (87%) included (2) "increased sputum volume;" and 54/63 (86%) included (3) "change in sputum purulence" and/or "change in sputum color". Although 53/63 (84%) included all 3 criteria, and only 16/63 (25%) specified how these criteria should be applied to trigger antibiotic use (6 – change in sputum color, volume or purulence; 3 – any 2 criteria; 2 - change in sputum color; 2 - change in sputum color and cough is worse; 1 - change in sputum color and "chest feels worse"; 1 - change in sputum or fever; 1 – any 2 criteria of change in sputum, dyspnea and fever). In terms of the treatment recommendations (Table 3), 47/63 (75%) plans recommended providing oral corticosteroids, but only 9/47 (19%) provided a specific dose and duration. Similarly, 45/63 (71%) plans recommended antibiotics, but only 2/45 (4%) suggested specific medications and 1/45 (2%) indicated dose and duration. Finally, other action plan content (Table 4) varied widely across plans.

Table 3 Recommendations Provided at Specific Action Points in COPD Action Plans

Treatment Recommendation	N (%)	Medication Recommended	N (%)	Dose and Duration	N (%)
Oral corticosteroid				Specific dose†	9/47 (19%)
Not recommended	16/63 (25%)			Blank field for dose	21/47 (45%)
				Unlabelled blank field	5/47 (11%)
				Take as directed††	2/47 (4%)
Recommended	47/63 (75%)	Prednisolone	18/47 (38%)	No direction provided	10/47 (21%)
1st action point	38/47 (81%)	Prednisone	13/47 (28%)		
2nd action point*	7/47 (15%)	Not specified	16/47 (34%)	Specific duration†††	9/47 (19%)
Last action point	2/47 (4%)			Blank field for duration	16/47 (34%)
				Unlabelled blank field	1/47 (2%)
				Take as directed††	2/47 (4%)
				No direction provided	19/47 (40%)

(*Continued*)

Table 3 (Continued).

Treatment Recommendation	N (%)	Medication Recommended	N (%)	Dose and Duration	N (%)
Antibiotic				Specific dose‡	2/45 (4%)
Not recommended	18/63 (29%)			Blank field for dose	24/45 (53%)
				Unlabelled blank field	5/45 (11%)
Recommended	45/63 (71%)	Doxycycline	1/45 (2%)	Take as directed‡‡	1/45 (2%)
1st action point	36/45 (80%)	Amoxicillin/doxycycline	1/45 (2%)	No direction provided	13/45 (29%)
2nd action point*	6/45 (13%)	List of options	1/45 (2%)		
3rd action point*	1/45 (2%)	Not specified	42/45 (93%)	Specific duration‡‡‡	1/45 (2%)
Last action point	2/45 (4%)			Blank field for duration	12/45 (27%)
				Unlabelled blank field	1/45 (2%)
				Take as directed‡‡	1/45 (2%)
				No direction provided	30/45 (67%)
Reliever inhaler				Specific dose§	7/45 (16%)
Not recommended	18/63 (29%)			Blank field for dose	23/45 (51%)
				Unlabelled blank field	1/45 (2%)
Recommended	45/63 (71%)	Blue inhaler	2/45 4(%)	No direction provided	14/45 (31%)
1st action point	45/45 (100%)	Salbutamol	1/45 (2%)		
		Ventolin or salbutamol	1/45 (2%)	Specific duration	0/45 (0%)
		Ventolin	1/45 (2%)	Blank field for duration	2/45 (4%)
		Albuterol/combivent	1/45 (2%)	Unlabelled blank field	0/45 (0%)
		Not specified	39/45 (87%)	Duration not specified	43/45 (96%)
Oxygen				Take as directed§§	10/16 (63%)
Not recommended	47/63 (75%)			No direction provided	6/16 (38%)
Recommended	16/63 (25%)			Take as directed§§	9/16 (56%)
1st action point	15/16 (94%)			Duration not specified	7/16 (44%)
2nd action point*	0/16 (0%)				
Last action point	1/16 (6%)				

Notes: *If not last action point (an action point is a point or "zone" indicating when to change treatment). †Prednisolone 30mg once daily (n=9), 6 tablets once daily (n=5); or prednisone 1 tablet once daily (n=1), 25–50mg once daily (n=1), 40mg once daily followed by taper (n=1). ††Take prednisolone as per instructions on medication box (n=1), as directed by physician if it has been prescribed for you (n=1). †††5 days (n=1), 7 days (n=4), 10 days (n=1), 5–10 days (n=1), 7–10 days (n=1), once daily until 2 days after feeling normal but no more than 2 weeks (n=1). ‡Doxycycline 100mg once daily (n=1); amoxicillin 500mg thrice daily or doxycycline 100mg twice daily (n=1). ‡‡Take antibiotic as per instructions on medication box (n=1). ‡‡‡5 days (n=1). §2–4 puffs as needed up to 4–6 times per day (n=2), 2–6 puffs at least every 4 hours (n=1), regularly for example every 4 hours (n=1), 1–2 puffs every 3–4 hours then 1–2 puffs every 2–4 hours (n=1), as frequently as needed (every 2 hours) (n=1). §§As prescribed or as told by your doctor (n=1), if prescribed (n=1), if on oxygen check the amount you are using (n=1), ask your doctor (n=1).

Table 4 Other COPD Action Plan Content

	Last action point	N (%)	Other Action Plan Locations	N (%)
Recommendations	Call emergency services	55/63 (87%)	Take your regular medications	45/63 (71%)
	Call physician	29/63 (46%)	Doctor/nurse/clinic contact details	40/63 (63%)
	Go to the emergency room	24/63 (38%)	List of usual COPD medications	36/63 (57%)
			Avoidance of inhaled irritants/triggers	34/63 (54%)
			Breathing technique	33/63 (52%)
			Smoking cessation	30/63 (48%)
			Flu and/or pneumococcal vaccination	27/63 (43%)
			Exercise regularly/exercise plan	28/63 (44%)
			Eat well/healthy or diet plan	27/63 (43%)
			Energy conservation technique	24/63 (38%)
			Keep hydrated	14/63 (22%)
			Baseline O_2 saturations	11/63 (17%)
			Consider pulmonary rehabilitation	11/63 (17%)

Format Analysis

In terms of format (Table 5), most APs were presented as tables (47/63; 75%) with two action points (47/63; 75%), used color (50/63; 79%), and employed a traffic light configuration (46/63; 73%). Plans varied in terms of number of pages, display orientation, narrative format, and font style/sizing. In terms of congruence with evidence-based design principles for printed educational material[24] (Table 6), plans fulfilled an average of 5.4 (standard deviation - SD 1.2) of 8 recommendations and only 1/63 (2%) plans met all applicable requirements.[44]

The average Flesch-Kincaid grade level was 6.5 (SD 1.6) (range 3.4–9.8) and the average Flesch reading ease score was 61.8 (SD 10.8) (range 32.9–87.4).

Table 5 COPD Action Plan Format Features

Format features	**N (%)**			
Display Orientation	Portrait 36/63 (57%)	Landscape 14/63 (22%)	Pamphlet or booklet 12/63 (19%)	Both portrait and landscape 1/63 (2%)
Number of pages	One 21/63 (33%)	Two 33/63 (52%)	Four 4/63 (6%)	More 5/63 (8%)
Plan configuration	Traffic light 46/63 (73%)	Other 17/63 (27%)		
Plan orientation	Columns 18/63 (29%)	Rows 42/63 (67%)	Text only 3/63 (5%)	
Number of action points*	One 4/63 (6%)	Two 47/63 (75%)	Three 11/63 (17%)	More 1/63 (2%)
Information format	Table 47/63 (75%)	Text 12/63 (19%)	Flow diagram 4/63 (6%)	
Use of guided prescription**	Yes 44/63 (70%)	No 19/63 (30%)		
Use of blank free text box	Yes 16/63 (25%)	No 47/63 (75%)		
Use of colors	Yes 50/63 (79%)	No 13/63 (21%)		
Use of graphical images	Yes 22/63 (34%)	No 41/63 (65%)		
Font style	Arial 20/63 (32%)	Times New Roman 7/63 (11%)	Calibri 25/63 (40%)	Other 11/63 (17%)
Font size	< 12 point 31/63 (49%)	12 point 25/63 (40%)	> 12 point 7/63 (11%)	
Narrative format	1st person 28/63 (44%)	2nd person 34/63 (54%)	Both 1st and 2nd person 1/63 (2%)	

Notes: *A point or "zone" indicating when to change treatment. **Defined as a preprinted statement with one or more blank spaces for health care professionals to fill.

Table 6 COPD Action Plan Congruence with Evidence-Based Recommendations for Printed Educational Material Design

Criterion	**N (%)**
Linking the amount of space between lines to the font size	37/63 (59%)
Using a larger font size with longer lines in header and footer text	55/63 (87%)
Limiting text in body section of AP to 70 characters per line	33/63 (52%)
Using ragged rather than justified right margins	63/63 (100%)
Using 12–14 point font size	32/63 (52%)
Using a serif font*	10/63 (16%)
Using lower-case letters in body of the text	63/63 (100%)
Using bold typeface rather than capital letters or underlining for emphasis	45/63 (71%)

Note: *One action plan included here alternates between serif and sans serif font.

There were no significant differences in readability or format scores between APs with or without published evaluation data, those published in 2020 or later versus earlier, nor by country of origin (data not shown).

Discussion

We collected 63 distinct COPD action plans (APs) from around the world and performed in-depth comparative content and format analysis. Despite APs being strongly recommended to improve care and outcomes, to our knowledge, this is the first analysis of this kind for COPD APs. Our findings reveal poorly reported development processes (and lacking end-user involvement), lacking AP evaluation, important variability across APs (including in content aspects which guide treatment decisions), and poor concordance with basic design principles. These limitations were systemic, and not explained by recency, published evaluation status, or geography.

Firstly, we could not find any information about the development process for the vast majority (89%) of identified APs. Among the seven APs with development details, only one included patients and two included primary care practitioners - the providers who see the vast majority of patients with COPD,[45] and where the AP usage gap is largest.[15] This suggests that most APs were likely developed "ad hoc", by experts, without involving the primary end-users of the tool itself. Yet the correlation between end-user engagement in tool development and end-user tool uptake is well-established across disciplines.[46,47] Specifically, COPD educational materials including self-management tools that were developed with patient engagement were shown to better reflect end-user preferences for content and layout, to improve comprehension, to augment self-management behaviors, and to improve health outcomes.[16] Efforts to co-develop a user preference-based COPD AP through collaborative patient, primary care provider, and expert engagement may help to bridge existing gaps in AP usage.[11–13,48]

Next, we found that few COPD APs were supported by evaluation data. Among APs identified through the internet, guideline, or organizational searches, only 4/58 (7%) had published evaluation data. Of these, the best studied was the LWWCOPD AP.[41] However, in all cases (including for APs identified through RCTs), COPD APs formed part of broader interventions, whereby we did not identify any data evaluating specific AP components (content/format) for their impact on efficacy. This may suggest that both expert groups and clinical trialists assume COPD APs are a standard self-management tool, rather than a complex intervention in itself, requiring component validation. However, this approach is at odds with our finding that COPD AP content, including medical directives, often lacked specificity and/or varied widely between identified plans in common use (Tables 1–4). The approach also does not acknowledge, and perhaps is a reason, that AP use is not uniform. For example, plans varied with respect to how descriptors at the first action point requiring patient action (eg Anthonisen's Criteria) should be applied to prompt use of antibiotics, and alarmingly, none specified the criteria that are recommended in published guidelines.[20,24] Also, few APs provided specific medication suggestions, doses and/or durations. This represents both a barrier to operationalization by providers and a potential source of clinically important differences in provided instructions (and thus, in expected outcomes). Furthermore, not all plans included behavioral cues for lifestyle and behavior modification such as trigger avoidance, exercise, and healthy eating. Similar content variability has been identified in the literature surrounding asthma APs.[49,50] A comparative meta-analysis[51] of features in asthma APs used across RCTs successfully identified which content permutations improved outcomes, supporting the importance of AP component validation. The observed variability and lack of specificity likely results from the lack of corresponding guidance across international COPD guidelines, in turn related to a lack of sufficient evidence.[52] The result of this uncertainty is an important lack of implementation support for providers, again likely contributing to existing usage gaps. In addition to expert consensus techniques to harmonize content across COPD APs, data-driven approaches such as comparative meta-analysis of COPD AP features should be considered.

Finally, we noted that COPD APs varied not only in content, but also in format (Table 5). Although it is unknown which specific COPD AP format features may be associated with better provider and patient uptake and/or outcomes, when assessed against widely espoused principles for educational content design,[25] identified COPD APs fulfilled an average of only 5.4 of 8 requirements, with only one plan[43] meeting all requirements. This is similar to findings in asthma APs,[49,53] and likely reflects content expert-driven development processes lacking graphic design and human factors expertise. Although the average Flesch-Kincaid reading grade level across APs was acceptable at 6.5 (corresponding to a middle school reading level),[26,54] given that usability shortcomings likely impact uptake at the provider level and adherence at the patient level, a focus on optimal COPD AP format and design is required.

Although this study did not evaluate actual patient uptake or clinical outcomes, extensive literature on patient-facing educational and decision-support tools[55] indicates that intrinsic characteristics that we identified to be problematic in COPD APs, including transparency of development methodology,[56] end-user involvement in development,[57] objective evaluation of effectiveness, consistency across versions, alignment with evidence-based guidelines,[6] and adherence to established principles of educational tool design,[58] are critical for successful implementation and sustained use. The widespread absence of these features across COPD APs identified in this analysis therefore represents a plausible structural contributor to observed gaps in AP adoption and use.

Conclusions

Despite evidence demonstrating their effectiveness[7,8] and strong guideline recommendations for their use, COPD APs are seldom used in practice.[6,12] Herein, we present the first comprehensive analysis of available COPD APs, identifying facets *intrinsic* to these APs that constitute potentially modifiable barriers to their uptake. These include a lack of end-user engagement in AP development, variable and non-specific medical guidance that is not guideline-concurrent, and variable formatting approaches that do not reflect best practice for educational content design. Consistent, structured advice on both pharmacologic and non-pharmacologic self-management approaches (such as exercise and pacing) may improve both usability and usefulness of COPD APs. Similar challenges were previously identified in asthma APs,[49,50,53] giving rise to creative strategies to engage end-users in tool development[59,60] and to ensure optimal usability,[61] leading to widely adopted user preference-based asthma APs.[61–63] We believe that similar evidence-based approaches will first be required to develop an optimal COPD AP, followed by prospective evaluation linking action plan design characteristics to real-world uptake and patient outcomes, before considering complex interventions to broadly increase uptake of this invaluable tool among both providers and patients.

Abbreviations

AP, action plan; COPD, chronic obstructive pulmonary disease; CTS, Canadian Thoracic Society; ED, emergency department; FPAGC, Family Physician Airways Group of Canada; GOLD, Global Initiative for Chronic Obstructive Lung disease; ICTRP, International Clinical Trials Registry Platform; LWWCOPD, Living Well with COPD; NICE, National Institute for Health and Care Excellence; RCT, randomized controlled trial; SABD, short-acting bronchodilator; SD, standard deviation.

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Disclosure

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The authors report no other conflicts of interest in this work.

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