# Management of Chronic Obstructive Pulmonary Diseases

#### Subjects: Others

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Chronic obstructive pulmonary disease (COPD) is a common, progressive respiratory disease that is growing in prevalence worldwide. The Global Initiative for Chronic Obstructive Lung Disease (GOLD 2023) defines COPD "as a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, expectoration and/or exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction.". GOLD is a well-known international organization, which is working to provide guidelines for COPD diagnosis, treatment, prevention, and management in order to assess the characteristics of COPD at a global scale, and to maximize available resources to support COPD care. In COPD management, pharmacological and non-pharmacological treatments are mostly administrated together.

digital health cOPD

## **1. Digital Solutions in Healthcare Services**

The term telehealth (TH) became the most common terminology to describe this integration of information and communication technologies (ICTs) and healthcare services. It is currently the preferred term because it captures the broad applications of this technology in providing healthcare services <sup>[1]</sup>. The term digital health is a relatively new concept, defined as "the use of digital technologies for health" <sup>[2]</sup>. Both TH and digital health are broad concepts that might include planning, monitoring, assessment, diagnosis, education, and treatment <sup>[2]</sup>. In the literature, TH or digital health have been used successfully within different health care disciplines, including cardio-respiratory disease management, and in the provision of home care or self-management for patients with chronic diseases such as Chronic Obstructive Pulmonary Disease (COPD) <sup>[3][4]</sup>. In addition, technology can be used in COPD care to improve the timeframe of therapeutic contact, or as an alternative tool when access to care is not available <sup>[5]</sup> **Figure 1**.



Figure 1. TH or Digital health concepts in COPD care.

#### 2. Benefits of Telehealth with Chronic Obstructive Pulmonary Disease Management

Systematic reviews and meta-analysis showed that TH solutions that support self-management could contribute to improve user's skills in controlling COPD, especially those with transport or economic limitations, or geographical barriers <sup>[4][6]</sup>. Considering the high cost of health care services, the TH approach could lower costs while maintaining quality of treatment in primary care clinics, decrease the pressure on the specialty care clinics, deliver tailored care, and facilitate the coordination of care among healthcare professionals <sup>[7]</sup>. Also, TH could be an opportunity to facilitate education reinforcement for professionals, patients and/or caregivers <sup>[8]</sup>. Additionally, digital

health allows for frequent reminders to be provided to users to practice behavior which strengthens an existing behavior, like self-monitoring and self-efficacy, or facilitates early interventions for COPD conditions by detecting their exacerbation at an early stage, and could therefore prevent unnecessary emergency visits and hospital readmissions <sup>[9][10]</sup>, as shown in **Figure 2**.



Figure 2. Benefits of TH with COPD management.

### 3. Structures of Telehealth Solutions

Development and innovation in digital health are steadily increasing <sup>[11]</sup>. Looking to digitalization alone as effective tool is not going to provide us with a better result in clinical practice. As clinicians, researchers could look at this technology as a key part of the package provided to the users. The package usually contains multiple components, which include complex mediums and interventions (i.e., telerehabilitation). However, it is difficult to evaluate the functionality of TH solutions that support disease management without considering three important components:

(1) the context that was provided, (2) the mechanisms that package components went through, and (3) the outcomes that the solutions are targeting. The answers to these questions still need further clarification <sup>[12][13]</sup>. One way to resolve this conflict is understanding the functionality of digital health solutions in COPD management <sup>[14]</sup>. This functionality could be understood from a theoretical perspective by identifying the associations between the context, mechanisms, and outcomes of current TH solutions that support disease management, in other words, the conceptual frameworks that enhance the connection between these elements and make technology a valuable tool in the delivery of care (**Figure 3**).



Figure 3. Structure of TH applications.

# 4. Context of Digital Health Solutions

The context of TH in COPD management includes three important factors: (1) the clinical setting, (2) digital health development, and (3) targeted populations. A summary of the literature is provided in **Table 1**.

 Table 1. TH interventions' characteristics from 2008 to 2023.

	Authors	Settings	Intervention with TH	Mode of Delivery	Intensity	Control Group Treatment	Summary of TH Outcomes Compared to Control Group
-	Trappenburg et al., 2008 [ <u>16</u> ]	Patient home (n = 165)	Software COPD self- management education	Telephone	1×/day for 6 months	Usual care	Reduction in AECOPD and hospitalization
	Koff et al., 2009 <sup>[<u>17</u>]</sup>	Patient home (n = 40)	Online COPD self- management education	Web-based and telephone	1×/day for 3 months	Usual care	Improved quality of life
	Halpin et al., 2011 <sup>[18]</sup>	Patient home (n = 79)	Automated text messages system	Text message	1×/day for 4 months	NR	Lower AECOPD but no change in quality of life
	Lewis et al., 2011 <sup>[19]</sup>	Patient home (n = 40)	Home monitoring	Telephone	2×/day for 6 months	Usual care	No difference in hospitalization or length of stay
	Stickland et al., 2011 <sup>[<u>17]</u></sup>	Community center (n = 409)	Online COPD self- management education	Web-based and video calls	2×/week	In-person rehabilitation	Improvements in quality of life
	Antoniades et al., 2012 [ <u>1</u> ]	Patient home (n = 44)	Online COPD self- management education	Web-based	1×/day for 12 months	Usual care	No reduction in hospitalization or improvement in quality of life
	Chau et al., 2012 <sup>[20]</sup>	Patient home (n = 40)	Telecare services	Web-based and telephone	3×/day for 2 months	Community services	No difference in health- related quality of life
	Dinesen et al., 2012 <sup>[21]</sup>	Patient home (n = 111)	Telerehabilitation	Video calls	1×/day for 4 months	Instructional book	Reduced hospitalization
	Nield et al., 2012 <sup>[22]</sup>	Patient home (n = 22)	Online COPD self- management education	Video calls	1×/week for 1 month	Usual care and in-person education	Decreased dyspnea

Authors	Settings	Intervention with TH	Mode of Delivery	Intensity	Control Group Treatment	Summary of TH Outcomes Compared to Control Group
De San Miguel et al., 2013 <sup>[23]</sup>	Patient home (n = 80)	Written COPD self- management education	Telephone	1×/day for 6 months	Usual care	Reduced hospitalization and length of stay
Pedone et al., 2013 <sup>[24]</sup>	Patient home (n = 99)	Telemonitoring	Web-based, telephone, and algorithm	1×/day for 9 months	Usual care	Reduced respiratory events and hospitalization
Pinnock et al., 2013 <sup>[25]</sup>	Patient home (n = 256)	Online COPD self- management education	Web-based, telephone, and algorithm	1×/day for 12 months	Usual care	Reduced admission to hospital but no change in quality of life
Schou et al., 2013 <sup>[26]</sup>	Patient home (n = 44)	NR	Video calls	1× /day for 3 months	Regular Hospitalization.	Improvements in lung volumes and oxygen saturation
Calvo et al., 2014 <sup>[9]</sup>	Patient home Medical center (n = 60)	Home care with TH	Web-based and telephone	1×/day for 7 months	Usual care	Reduction in ER visits, hospitalization, and length of stay
Tabak et al., 2014 <sup>[27]</sup>	Patient home (n = 29)	Online COPD self- management education	Web-based and Video calls	1×/day for 9 months	Usual care	Increased patient adherence to exercise
Berkhof et al., 2015 <sup>[28]</sup>	Medical center & patient home (n = 101)	Phonecalls, education and follow ups	Telephone	Call/2 weeks for 6 months	Usual care	No improvements in health status
Jakobsen et al., 2015 <sup>[29]</sup>	Patient home (n = 57)	Virtual hospital	NR	1×/day for 6 months	Regular hospitalization	Reduced re- admission to hospital due to AECOPD
McDowell, 2015 <sup>[30]</sup>	Patient home (n = 110)	Home-based health care	Telephone	1×/day for	Usual care	Improved health related quality of life.

Authors	Settings	Intervention with TH	Mode of Delivery	Intensity	Control Group Treatment	Summary of TH Outcomes Compared to Control Group
				6 months		
Ringbeak et al., 2015 <sup>[<u>31</u>]</sup>	Patient home (n = 281)	Online COPD self- management education and home exercise	Video calls	3×/week for 6 months	Usual care	No change in dropout or mortality
Tucker et al., 2016 <sup>[32]</sup>	Patient Home (n = 65)	Written home exercise with TH	Telephone	Call/2 weeks	Usual care	Improvement in physical activity
Ho et al., 2016 <sup>[33]</sup>	Patient home (n = 106)	Telemonitoring	Web-based and telephone	1×/day for 2 months	Usual care	Reduced number of hospitalizations due to AECOPD
Ringbeak et al., 2016 [ <u>34</u> ]	Patient home and outpatient (n = 116)	Online COPD self- management education and home exercise	Web-based, video calls	NR	In-person rehabilitation	Improved physical capacity but no improvement in CAT score.
Vianello et al., 2016 <sup>[35]</sup>	Hospital (n = 334)	Online COPD self- management education	Web-based and telephone	1×/day for 12 months	Usual care	Reduced readmission rate due to AECOPD
Farmer et al., 2017 <sup>[36]</sup>	Patient home (n = 116)	COPD self- management education with TH	Web-based	1×/day for 12 months	COPD self- Management education without TH	Improved health status and quality of life
Lilholt et al., 2017 <sup>[<u>37</u>]</sup>	Patient home and community center (n = 1225)	Telerehabilitation	Web-based, and telephone	NR	In-person rehabilitation	No difference in quality of life
Shany et al. ,2017 <sup>[<u>38]</u></sup>	Patient home (n = 42)	Online COPD self- management education	Web-based and telephone	1×/day for 12 months	Home care	Reduction in hospitalization and length of stay

Authors	Settings	Intervention with TH	Mode of Delivery	Intensity	Control Group Treatment	Summary of TH Outcomes Compared to Control Group	
Tsai et al., 2017 <sup>[39]</sup>	Patient home (n = 37)	Online COPD self- management education and home exercise	Video calls	3×/week	Usual PR	Improvements in physical capacity and quality of life	
Soruano et al., 2018 <sup>[40]</sup>	Patient home (n = 237)	Telemonitoring	Internet modem	1×/day for 12 months	Usual care	TH did not reduce hospitalization due to AECOPD	э, К.; 18,
Jolly et al., 2019 <sup>[4<u>1</u>]</sup>	Patient home (n = 58)	Multimedia COPD self- management education and telephone coaching	Telephone	1×/day for 12 months	Usual care	Improvement in uptake in PR program	during
Jiang et al., 2020 <sup>[42]</sup>	Patient home (n = 106)	TelePR program	WeChat	3×/week for 6 months	Usual PR	No difference in symptoms score between TelePR and UC	2000, 4.A.
Rassouli et al., 2021 <sup>[<u>43</u>]</sup>	Patients home (n = 168)	Online COPD self- management education	Web-based and telephone	5×/week for 6 months	Usual care	TH use improved CAT score and satisfaction with care.	of Im.
Zanaboni et al., 2022 <sup>[44]</sup>	Patients home (n = 120)	TelePR	Video calls	3×/week for 2 years	Treadmill at home	TH redued hospitalization.	Saudi
Polo et al., 2023 <sup>[<u>45</u>]</sup>	Hospital and participants' home (n = 209)	COPD TelePR program	Zoom and web- conferencing	2×/week for 2 months	Usual PR	TH improved COPD symptoms, fatigue, self- management, and lung volumes.	J.D.; nealth

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