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Scientific letter

Can a Telemedicine Program Reduce the Number of Admissions in the Second and Third Month After Hospital Discharge for an Exacerbation of COPD Compared to a Conventional Follow-up System?

¿Puede un programa de telemedicina reducir el número de ingresos en el segundo y tercer mes tras el alta hospitalaria por una agudización de EPOC en comparación con el seguimiento convencional?

Dear Editor:

Patients with chronic obstructive pulmonary disease (COPD) experience worsening of their symptoms beyond their usual daily variations, requiring modifications in their normal treatment.[1] These situations, known as exacerbations (COPDE), favor the progression of the disease and increase mortality.[2] In our hospital we offer a *face-to-face* follow up to high-risk COPD patients, the Ambulatory Chronic Respiratory Care Unit (ACRCU), during the first 30 days after a COPDE discharge. In it, specialized nurses visit them at home, in order to identify early relapses. ACRCU is useful for reducing admissions at and increasing the one-year post-discharge survival.[3] Additionally, we proposed the use of telemedicine after ACRCU, during de second and third post-discharge months. Telemedicine has gain great interest due to its potential ability to reduce complications in chronic diseases thanks to a more frequent follow-up compared to standard care.[4] Nevertheless, to date published evidences in this field are contradictory.[5–8]

We designed a cohort study in order to reduce the admissions due to COPDE during the second and third post-discharge months, as well as the average length of hospital stay (LOHS) in case of admission and the number of visits to the Emergency Department (ED). We established two groups after ACRCU finished: one telemonitored (TM) and other with a conventional follow up (CFU) (see additional material). The study was approved by our Research Ethics Committee (EO45/2016-FJD).

In the TM a form was sent weekly through our Hospitality Patient's Application. Patients were asked to answer *yes or no* to the following questions: increased dyspnea, cough, and/or expectoration or purulent sputum. Temperature (Ta), arterial oxygen saturation ($SatO_2$), and heart rate (HR) were also declared. Forms were attended from 08:00 a.m to 08:00 p.m from Monday to Friday by our specialized nurses. An affirmative answer to any of the questions, a Ta > 37.5 °C, a HR > 120 beats per minute (bpm) or a $SatO_2$ < 88% with the usual inspired fraction of oxygen led to a phone call to the patient. Then the patient could receive instructions for home monitoring and minor therapeutic adjustments or be referred to the Day Hospital (DH) for physical evaluation by a pulmonologist. In the CFU, patients attended their Primary Health Center or the ED in case of clinical worsening.

As a method of statistical analysis we use means and standard deviations, as well as numbers associated with their percentages to describe demographic and clinical characteristics. For comparisons between proportions, we used Student's *t* and chi square test. We consider $p < 0.05$ as significant.

98 patients were registered for ACRCU during a year. Most of them were men (71.42%) with a mean age of 75.56 (±9.57) years. They presented an average of 2.48 (±2.24) annual COPDE. A 59.1% presented a 3–4 GOLD obstruction level. 25 of these patients were selected for the TM, as they met all the selection criteria. The patients who did not, were included automatically in the CFU. The main limitation for recruitment was the incapacity for managing electronic devices of these patients or their main caregivers. The characteristics of both populations are shown in Table 1.

We received 189 forms (7.5 per patient) and made 60 phone calls. In 23 of these calls, we confirmed the need for therapeutic adjustments (43.5%) or a visit to the DH (56.5%) In these cases, the altered items were dyspnea ($N = 8$); cough ($N = 8$); secretions ($N = 7$); purulence ($N = 7$), Ta > 37.5 °C ($N = 7$), HR > 120 bpm ($N = 0$); $SatO_2$ < 88% ($N = 1$).

There were 22 admissions due to COPDE [TM 5 (20%) vs. CFU 17 (23.28%) $p = 0.734$] and mean LOHS was 7.46 days [TM 7.80 (±7.95) days vs. CFU 7.12 (±3.85) days; $p = 0.789$]. There were 23 visits to the ED [TM 4 (16%) vs. CFU 19 (26%); $p = 0.307$]. However, the COPDE that were evaluated in the DH by a pulmonologist (TM group) had significantly fewer hospitalizations than when managed in the ED (CFU group) (TM 29.42% vs. CFU 89.7%; $p < 0.01$).

COPD patients who benefit the most from TM are those more severe or at a higher risk, as in our cohorts.[9,10] Given the fragility of this population, the need for admission during a mild to moderate COPDE may be almost mandatory. TM can help to control the course of COPDE preventing a critical worsening.[11] Our forms were able to detect situations compatible with COPDE, most of which were handled in DH or even with a telephone call. COPD affects older people, sometimes with sensory or cognitive deficits, and poor use of technology. We tried to establish a simple TM system with short weekly forms. Other researchers with better outcomes monitored their patients more frequently[12,13] or use more variables.[13,14] Our simplification may have limited our patients' control, making some COPDE go unnoticed. It is also worth mentioning that our TM system was available from 8:00 a.m. to 8:00 p.m. from Monday to Friday, so incidents outside these boundaries necessarily had to be managed at the ED.

ACRCU program includes health and self-care promotion. The fact that all these patients had previously been trained during ACRCU, may have masked the potential benefits of a telemedicine program. Our small sample size, the disbalance number of patients

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Table 1
Main characteristics of our studied population.

Variables	Conventional follow-up (CFUG) $N = 73$	Telemedicine (TMG) $N = 25$	p
Sex			
Male	52 (71.23%)	18 (72.00%)	0.942
Female	21 (28.77%)	7 (28.00%)	
Age (years)	76.75 (±9.88)	72.08 (±7.34)	**0.034**
Smoker			
Current	20 (27.40%)	1 (4.00%)	**0.014**
Former	53 (72.60%)	24 (96.00%)	
Flow obstruction (GOLD)			
Mild	1 (1.37%)	–	**0.020**
Moderate	32 (43.84%)	7 (28.00%)	
Severe	31 (42.47%)	16 (64.00%)	
Very severe	9 (12.33%)	2 (8.00%)	
Dyspnea (mMRC)			
1	19 (26.03%)	3 (12.00%)	0.206
2	23 (31.51%)	11 (44.00%)	
3	28 (38.36%)	8 (32.00%)	
4	3 (4.11%)	3 (12.00%)	
COPDE (episodes in the 12 last months)	2.42 (±2.21)	2.64 (±2.37)	0.681
Severe COPDE	2.12 (±2.11)	1.72 (±1.46)	0.382
Bacterial isolation in sputum (12 last months)	28 (38.36%)	8 (32.00%)	0.569
Inhalator therapy			
LAMA or LABA	2 (2.74%)	–	0.236
LABA–LAMA	5 (6.85%)	2 (8.00%)	
LABA–ICs	9 (12.33%)	–	
LABA–LAMA–ICs	57 (78.08%)	23 (92.00%)	
Long term oxygen therapy	45 (61.64%)	16 (64.00%)	0.834
Home – non invasive ventilation	11 (15.07%)	6 (24.00%)	0.309
GOLD classification			
A	6 (8.22%)	–	0.401
B	9 (12.33%)	4 (16.00%)	
C	13 (17.81%)	3 (12.00%)	
D	45 (61.64%)	18 (72.00%)	
COPDE managed in the emergency department	19 (26%)	4 (16%)	0.307
COPD admissions	17 (23.28%)	5 (20%)	0.734
Length of stay (days)	7.12 (±3.85)	7.8 (±7.95)	0.789
Total COPDE evaluation ending in a admission	89.7%	28.41%[a]	**<0.01**

LAMA: long-acting anticholinergic; LABA: long-acting beta agonists; ICs: inhaled corticosteroids.
[a] We also take on account the physical evaluations made at DH ($N = 13$) plus 4 in the ED: 17 COPDE evaluations in total in our TMG.

in each group, the lack of randomization and the fact that recruitment for TM group was so strongly influenced by technology management are also limitations.

On the other hand, we want to highlight that TM patients who required physical evaluation at DH ended up admitted significantly less than the CFU patients seen in the ED. This can be due to an early identification of symptoms, and also to an easier access to specialized care.

We conclude that, although our TM program did not achieve a statistical significant decrease in COPDE admissions, ED visits, or mean HLOS, it has the potential to modify the critical evolution of some COPDE in selected patients (fragile or severe), through early identification and specialized and prompt treatment. Solutions to overpass the lack of technological management as a limitation for its use are needed in order to benefit a larger population.

Informed consent

Written informed consent was not required from patients to participate in the study, as it was conducted following usual clinical practice. We ask for verbal consent and agreement to complete the TM follow up.

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Authors' contributions

NPA, VAF and PBG provided study design and guidance of the project. NPA performed the statistical analysis. NPA, CLC, AFR and GPMT were involved in patient recruitment and data collection. NPA and VAF made the analysis and bibliographic review. All authors contributed in writing of the final paper. All authors read and approved the final manuscript.

Conflict of interest

VAF has attended or participated in activities organized or financed by the pharmaceutical companies Almiral, AstraZeneca, Bial, Boehringer Ingelheim, Chiesi, GlaxoSmithKline, Esteve, Ferrer, Menarini, Novartis, Mundipharma, Orion, Pfizer, Teva and Zambon.

VAF is part of the Editorial board of Open Respiratory Archives and declare that they have remained outside the evaluation and decision-making process in relation to this article.

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The rest of the authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.opresp.2022.100222.

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