Telehealth and Telecare: A Real-Life Integrated Experience in the COVID-19 Pandemic

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Abstract

Background: *In the first few months of 2020, Lombardy was the hardest-hit region in Italy for COVID-19 cases. Our Rehabilitation Institute offered a telemedicine service to COVID-19 patients discharged after hospitalization.*

Methods: *Patients transferred from Emergency, Intensive Care, and Pulmonology departments of the principal regional hospital hubs had an average stay in our hospital of 2–3 weeks. On discharge, at home, they underwent a telecare nursing and specialist teleconsultation program for 3 months, including monitoring of vital signs and symptoms. Patients completed the SF-12 questionnaire at the start and end of the program and rated their satisfaction with it.*

Results: *The program involved 130 patients (51%). During the period, there were 14 ± 2 (1,800 in total) telenursing support phone calls per patient made, and 12.5 ± 3.4 oxygen saturation readings per patient (1,631 in total). Persisting symptoms, frequently in combination, were present at the start of the program in 124 (94%) patients. There was a significant reduction of symptoms ($p < 0.0000$) after the telecare program. The physical component of SF-12 significantly improved at the end [$\Delta(t1–t0) = 6.7 \pm 9.3$, $p < 0.0001$]. On the contrary, the mental component of SF-12 remained unchanged or decreased slightly in patients ≤70 years of age [$\Delta(t1–t0) = -2.7 \pm 12.3$, ns], while it decreased significantly [$\Delta(t1–t0) = -5.4 \pm 12.4$, $p = 0.0367$] in older patients (although remaining mild). Patient satisfaction with the program was very high in all 130 patients.*

Conclusions: *Our Telehealth and Telecare Service offers an example of rapid scaling and adaptation of an existing program to meet the needs of COVID-19 patients. Our findings indicate that telemedicine can be an integral part of clinical practice if supported by the institution with training and IT support provided to patients, nurses, and clinicians.*

Keywords: *COVID-19*, *telehealth*, *telemedicine*, *telenursing*, *electronic health record*

Introduction

The rapid spread of disease and increase in confirmed cases of acute respiratory infection due to the coronavirus SARS-CoV-2 have posed an enormous challenge to health care systems worldwide[1]. In the first months of 2020, the Lombardy Region, in particular the territories of Bergamo and Brescia, was the hardest-hit region in Italy with a rapid increase in COVID-19 cases.[1–3] Telemedicine in this pandemic[4–6] proved an invaluable way to provide access to care when social distancing created a barrier to face-to-face care. In a secure monitored and managed environment, the home could become the site of isolation of the virus and, if necessary, of diagnosis, and management of the disease.

Elderly people with comorbidities, in particular hypertension, coronary artery disease, or diabetes, are more susceptible to SARS-CoV-2 infection and more at risk of developing severe symptoms and of an unfavorable outcome.[6] Long-term follow-up studies on persistent symptoms, lung function, physical, and psychological problems of discharged COVID patients exist in the literature.[7,8] They report persisting symptoms such as fatigue and dyspnea, impaired pulmonary function, and many other symptoms in patients following hospital discharge.

For this reason, based on our previous experience[9] with telecare and telemonitoring of patients with chronic heart failure and chronic obstructive pulmonary disease, we decided to offer our telemedicine service to COVID-19 patients following hospital discharge. In this article, we describe the rapid change we made in our program to adapt it to the COVID patients, the typical problems that we encountered and addressed along the way, the solutions proposed, and some preliminary observational data that emerged from the program.

Materials and Methods

STUDY DESIGN AND PARTICIPANTS

During the COVID crisis, our rehabilitation Institute in Lumezzane, Brescia, like other hospitals in Lombardy, underwent a complete transformation within a few days from a Cardiorespiratory/Neurological Rehabilitation center to become a hospital for COVID-19 patients. We received patients directly from Emergency, ICU, and Pulmonology departments from the principal hospital hubs in Bergamo and Brescia. These patients remained as inpatients in our hospital for an average of 2–3 weeks; after this period, they were ready to go home or else were transferred to the appropriate rehabilitation department.

When discharged, patients were followed at home by a telecare nursing and specialist teleconsultation program for 3 months. The key element of the program[9] was a structured nurse-managed telephone support and, when necessary, video consultations, to follow patients, for the first month. During the first 2 weeks, we made contact on a daily basis, according to the patient's clinical needs; in the following 2 weeks, we reduced it to one call per week (more if the patient needed). During these contacts, the nurse carried out a standardized interview enquiring about the general clinical condition of the patient, using assessment questions to detect if the patient's signs and symptoms were worsening or, on the contrary, improving. The nurse also counseled the patient on weight management and physical activity, dietary changes, stress management, and specific targets set to increase the patient's empowerment in relation to their disease. In the case of any symptom or problem, the patient could call the service (preferably) from Monday to Friday from 8:00 to 16:00. In any case, it did not replace the emergency service. For the subsequent 2 months, we left patients free to call the nurse if needed at any time during the day. Finally, at the end of the third month, we contacted the patients again to check their clinical condition and to close the program. *Figure 1* represents the workflow model.

At the time of hospital discharge, patients were provided with a pulse oximeter to measure O_2 saturation initially at rest and later during a walk or exercise at home and during the night.

At the start of the program, then at 1 week after hospital discharge, and finally at the end of the program, during the phone contacts, patients were administered the validated Italian version of the SF-12 quality-of-life questionnaire.[10–12] This questionnaire has a 6-item physical component summary (PCS) and a 6-item mental component summary (MCS). The PCS questions include one about general health, one about bodily pain, two about physical functioning, and two about physical role. The MCS questions consist of one about vitality, one about social functioning, two about role limitation due to emotional problems, and two about mental health.[10–13] The scores of the quality-of-life domains range from 0 to 100, with higher scores indicating higher quality of life. The two summary scores were collected and analyzed in accordance with published indications[13,14]; we analyzed scores in terms of the whole population and two subgroups divided by age ≥70 years versus <70 years.

A COVID-19-monitoring electronic sheet was created modifying one of the electronic data sheets used by our service. It recorded oxygen saturation percentage, heartrate, temperature, clinical parameters, and any signs and symptoms (*Fig. 2*). Based on the patient's answers and the presence or absence of different symptoms, the nurse was instructed to capture indicators of instability requiring specialist advice and, in the case of severe deterioration, to refer the patient to the Emergency room or hospital readmission.

The nurse asked patients about the prescribed therapy and if they were taking their medications regularly. Frequently, it was necessary to reintroduce drugs that had been interrupted during the acute phase of the COVID disease. Following the instructions of the physician, the nurse helped patients to restart their long-term therapy or find the right dosage of drugs, trying to empower the patient vis-à-vis the importance of each drug for the relative disease. In specific cases, the nurse asked the specialist to speak with the patients in videoconference. From both the scheduled and unscheduled telephone calls, the nurse relayed the relevant information to the clinical specialist who, based on the information received, provided feedback or modified the patient's therapy.

Patient satisfaction was assessed at the end of the program through a short questionnaire consisting of two questions:

1. Was the program useful for the patient?
2. Did the nurse provide clear indications and answers to the patient's requests?

Each question was rated from 0 (not at all satisfied) to 4 (very satisfied), with a maximum score of 8. Retrospective approval for publication of these fundings was provided by the institutional review board of "Istituti Clinici Scientifici MAUGERI" (2455CE, 30 June 2020).

DATA ANALYSIS

Continuous variables were expressed as mean ± standard deviation, and categorical variables as number and percentage. The analysis was carried out with GraphPad Prism 4 version 4.03, and a paired *t*-test for two samples with equal variance on the two SF-12 components (PCS and MCS) to determine a significant pre/post difference.

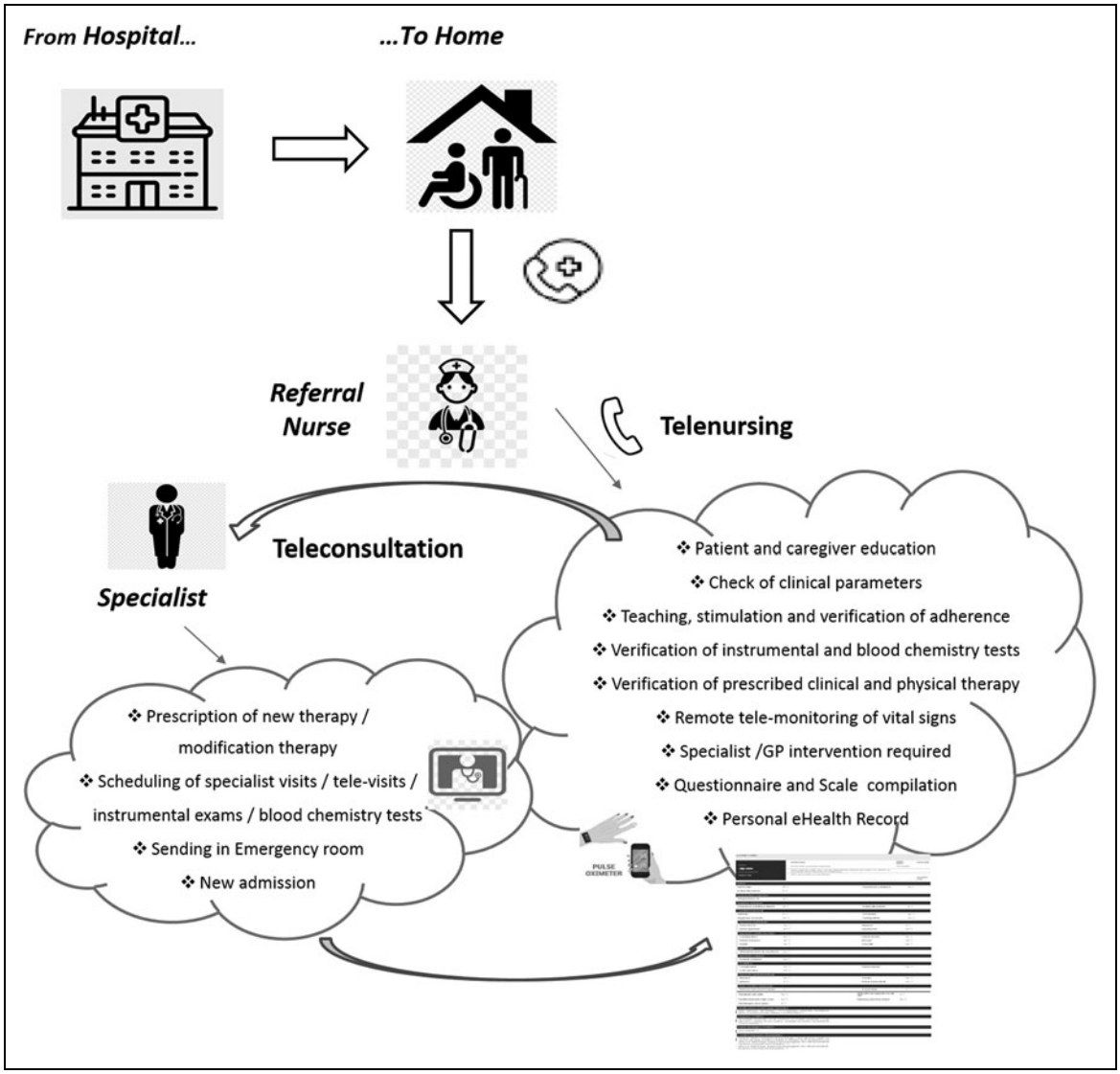

Fig. 1. Workflow model.

The χ^2 analysis was performed to compare frequencies of problems/symptoms observed between the beginning and the end of the home-based telecare period. A p-value <0.05 was considered statistically significant.

Results

From March to June 2020, 304 patients were hospitalized in our Institute for COVID-19. Of them, 130 patients (51%) were followed upon discharge with the home telecare program. *Figure 3* shows the flow of patients through the study and *Table 1* reports the characteristics of the patient population.

HOME-BASED TELECARE PERIOD

During the period, a total of 1,800 phone contacts were made by the nurse, 14 ± 2 per patient. The average number of O_2 saturation data acquired was 12.5 ± 3.4 per patient (1,631 in total). All actions were focused on educational reinforcement and verification of therapeutic compliance. Most patients, 124 (94%), still had at the start of the program, open symptoms among those represented in *Figure 2*: the main ones were anxiety and/or altered mood ($n = 67$, 52%), dyspnea at mild-to-moderate exercise ($n = 56$, 43%), asthenia ($n = 64$, 49%), myalgia ($n = 24$, 18%), and cough ($n = 17$, 13%). Very often, patients had a combination of symptoms. Regarding the presence/absence of signs and symptoms, the number of

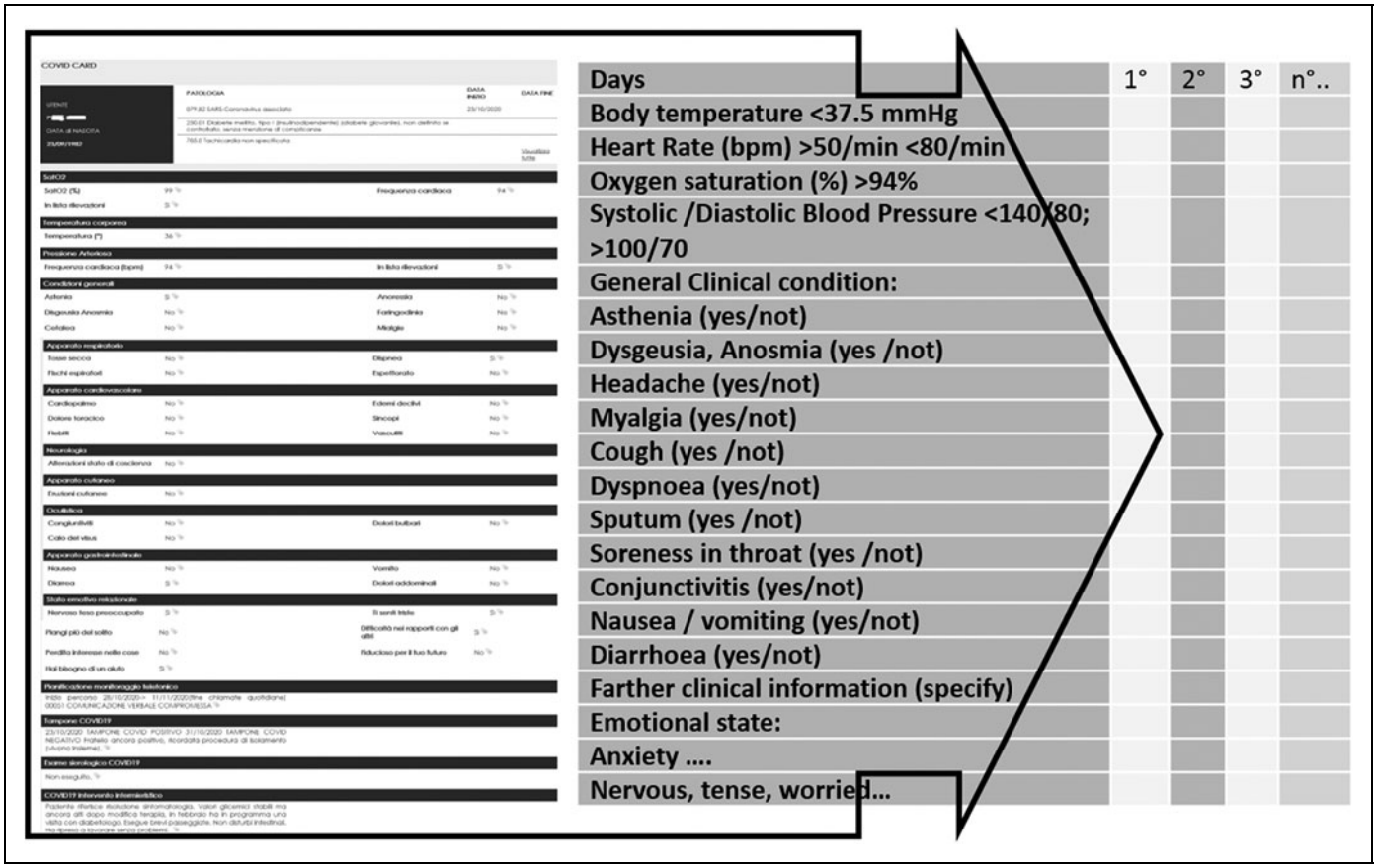

Fig. 2. COVID-19-monitoring electronic dashboard.

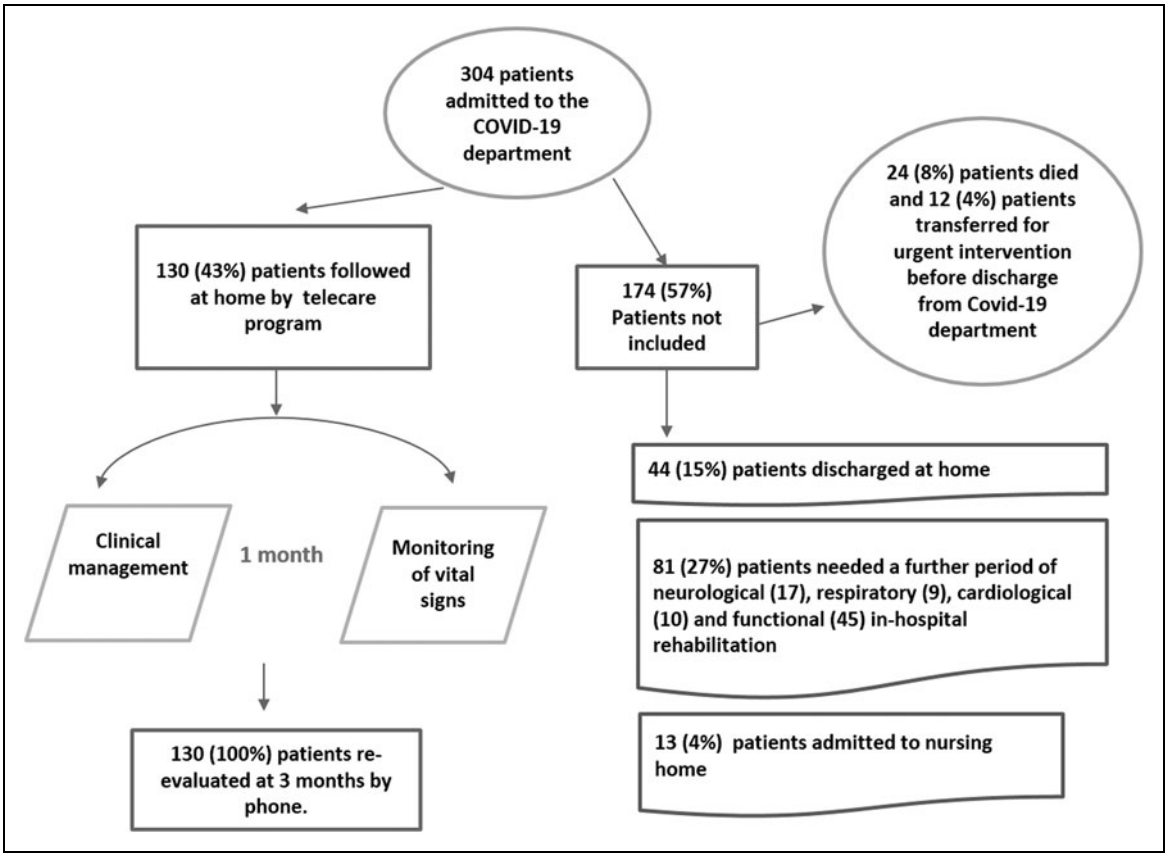

Fig. 3. Flow of patients through the study.

Table 1. Characteristics of the Patient Populations at Baseline

PATIENTS	*N* = 130
M/F (%)	73/57 (56%/44%)
Mean age ± SD (years)	68 ± 11
Female, mean age ± SD (years)	67 ± 12
Male, mean age ± SD (years)	70 ± 10
Acute phase	
Length of stay, days	38 ± 22
Pneumonia from COVID-19 (%)	114 (89%)
Pulmonary embolism (%)	8 (6%)
O_2 therapy (%)	105 (82%)
Mechanical ventilation	45 (35%)
Stroke	1 (0.8%)
Principal comorbidities (%)	
Diabetes	26 (20%)
Hypertension	57 (44%)
Chronic heart disease	30 (23%)
Chronic respiratory failure	19 (14%)
Neoplastic diseases	17 (13%)
Patients with 0 comorbidities	12 (9%)
Patients with 1–2 comorbidities	75 (58%)
Patients with ≥3 comorbidities	43 (33%)

SD, standard deviation.

problems observed per patient varied (*Table 2*). We found a significant reduction in symptoms ($p < 0.0000$) after the telecare program.

The number of teleconsultations with a specialist (pulmonologist, cardiologist, or neurologist) was 1.0 ± 1.1 per patient (114 in total), with a general practitioner 0.3 ± 0.6 (38 in total). Drug therapy changes suggested during the telephone calls were 0.70 ± 0.90 per patient (90 in total).

Table 2. Number of Problems Observed at the Beginning and at the End of Home-Based Telecare Period

PROBLEMS	AT THE BEGINNING PATIENTS, N (%)	AT THE END PATIENTS, N (%)	*p*
<2	57 (44%)	100 (77%)	0.0000
2–3	61 (47%)	26 (20%)	
>3	12 (9%)	4 (3%)	

In five patients, the nurse, after teleconsultation with a specialist, advised the patient during the phone call to report to the Emergency room. Seven patients were readmitted for all causes.

Table 3 presents the results of the SF-12 quality-of-life questionnaire. We were able to analyze the pre/post difference in 121/130 patients: 61 patients ≤70 years of age and 60 patients >70 years of age. All parameters of PCS significantly improved at the end of the 3-month program. On the contrary, overall, the MCS components did not change significantly or worsened slightly, particularly in older patients.

Patient satisfaction with the program was very high in all 130 evaluated patients, with an overall mean score of 7.6 ± 0.9.

Discussion

The Maugeri Telehealth system[9] was able to set up rapidly a telemedicine-based program for the management of COVID-19 patients, and preliminary data suggest that such a program may be effective. In the process of setting up the program, we overcame several hurdles and we learned several things along the way. Our data show that, among the 130 patients studied, dyspnea, anxiety, asthenia, and myalgia were the most common symptoms reported; these are frequently reported in other published articles.[15] The program succeeded in facilitating the resolution of the clinical problems and enabling the patients to achieve the best possible level of autonomy at physical, functional, social, intellectual, and relational level. The purpose of the intervention was to keep the evolution of the disease under control, to provide counseling and support to the patients, to assist recovery, and to identify early any signs and symptoms related to a possible resumption of COVID-19 disease and/or comorbidities.

Our preliminary data confirm that most of the clinical problems of the COVID-19 patients were resolved, physical activity increased, and the patients were satisfied with the 3-month program. On the other hand, the Mental Component of SF-12 (questions on anxiety and depression) did not change or got worse in most of the patients, in particular in the older ones. Also in other studies,[16–18] anxiety was reported as severe, as testified by the increased demand for mental health and counseling services during the COVID-19 crisis. A number of factors certainly contributed to determining this anxiety and depression state, or aggravating it, if already present. The severity of the COVID-19 disease, whose onset in patients was unexpected and often initially underestimated

Table 3. SF-12 Quality-of-Life Questionnaire at the Beginning and at the End of Home-Based Telecare Period

SF-12	AT THE BEGINNING	AT THE END	DELTA (T1–T0)	*p*
PCS12 ($n=121$)	39.7 ± 7.6	46.2 ± 7.5	6.7 ± 9.3	<0.0001
In patients ≤70 years ($n=61$)	40.3 ± 7.4	47.6 ± 7.6	7.4 ± 9.2	0.0003
In patients >70 years ($n=60$)	39.2 ± 8.0	44.8 ± 7.4	5.7 ± 94	0.0053
MCS12 ($n=121$)	54.4 ± 8.1	51.7 ± 10.8	−2.7 ± 12.3	ns
In patients ≤70 years ($n=61$)	54.6 ± 5.5	54.8 ± 9.2	0.3 ± 11.4	ns
In patients >70 years ($n=60$)	54.3 ± 10.1	48.7 ± 11.7	−5.4 ± 12.4	0.0367

MCS, Mental Component Summary; PCS, Physical Component Summary.

(especially in the first months of the pandemic), together with the presence of other chronic problems complicating the symptoms, were clear triggers for anxiety and depression. On top of this was patients' anxiety for their family members, often also affected by the infection, the stress of continuous exposure to negative news on the subject, the inability to see family members for long periods of hospitalization, and the large number of deaths.

Recovering from these problems took a long time and required psychological support, which may be the easiest mode for providing mental health care.[19] During the period of this study, it was not possible to implement telepsychology for all patients; this support was reserved only for particularly serious situations.

Through telecounseling, the nurses tried to help patients manage their symptoms and the various daily problems encountered, and to reduce the sense of isolation generated by the lockdown situation, and this had a positive effect, although partially, on the patients' state of anxiety.

Based on this program, in November 2020 we started a multicenter controlled program (MIRATO project founded by "Welfare Regione Lombardia") for COVID-19 patients. In this (ongoing) program, we have implemented high-technology assessment and, in addition to the telenursing program, we have added telemonitoring of the SpO_2 trend for most patients, video consultations with nurses and specialist, and telepsychology.

Our previous experience had already evidenced the utility of telepsychology support for chronically ill patients and their families.[20,21] Wells et al.[22] reported, the pandemic has accelerated the implementation of telehealth platforms to provide also psychological support, and there has been a remarkable transition to telepsychology during the COVID-19 pandemic. Alqahtani et al.[23] suggested that telepsychology should be part of a proactive governance model to ensure continuity of mental health care services.

Given the complexity of some patients, the nurses in our telemedicine service team were encouraged to put any clinical questions to the entire group to get an answer from someone with more experience in that matter in real time. This aspect was reported also in other studies that use Microsoft Team meetings for the same purpose.[24] The dramatic increase in telehealth adoption and utilization during the pandemic underscores a need to develop a procedure to support the transition from face-to-face service to telehealth.[25,26] It requires a more organized approach to using telehealth tools involving not only professionals and technology but also patient groups and companies who offer e-health services. For this reason, we would translate the principal set of skills required into specific competencies, in particular for the nurse, and we are planning a Master's degree course in Case Management in Nursing that can open the doorway to more opportunities for nurses to work with telemedicine services.

Telemedicine promotes empowered patients and health care professionals that are able to make more informed and accurate decisions. It is important to help patients, in particular chronic patients, to take responsibility for their own health status and self-care.[27] The patient and the nurse, together, can identify symptoms as well as manage the physical, emotional, and social impact of the disease, leading to an improved quality of life. In this COVID-19 pandemic, it is important to accelerate the training of patients and caregivers on how to care for this specific disease.

In our study, the patients' satisfaction was very high, even in those without previous telehealth experience, in line with the results of other reports.

LIMITATIONS OF THE STUDY

Our program has some limitations. Given the emergency phase in which our service was organized and the high degree of contagion risk, it was not possible to enlist the support

of caregivers (a fundamental aspect) in the enrolment phase, nor could we provide adequate education to the patient, a key factor in our model. Hence, we decided to provide everyone with a minimum level of technology (telephone) rather than use a high-technology service (videoconference/app), available only for a small proportion of the patients. For similar reasons, we could make little use of biological signal telemonitoring and trend readings of O_2 saturation. Another limitation was the fact that the telepsychological support was activated at home only in a few cases.

Conclusions

The Telehealth and Telecare Service offers an example of rapid scaling and adaptation of an existing program to meet the needs of patients with COVID-19 disease. These results indicate that a telemedicine service can be an integral part of clinical practice now and in the future, if supported by the institution with training and IT support to both patients, nurses, and clinicians.

Authors' Contributions

P.B. and S.S. contributed to the study design and drafted the article; P.B. and F.B. contributed to prepare and analyze the data; M.S., G.A., M.Z., E.P., and S.G. followed the patients and collected the data. All authors reviewed and approved the final article.

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Disclosure Statement

No competing financial interests exist.

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