

1 Running head: rehabilitation services through telemedicine

2 Feasibility and acceptability of telemedicine to substitute outpatient
3 rehabilitation services in the COVID-19 emergency in Italy: an observational
4 everyday clinical-life study

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18

19 [Abstract](#)

20 **Objective:** To investigate the feasibility and acceptability of telemedicine as a substitute of outpatient
21 services in emergency situations like by the sudden surge of the COVID-19 pandemic in Italy.

22 **Design:** Observational cohort study with historical control.

23 **Setting:** Tertiary referral outpatient Institute.

24 **Participants:** Consecutive services provided to patients with spinal disorders.

25 **Interventions:** Telemedicine services included teleconsultations and telephysiotherapy. They lasted as long
26 as usual interventions. They were delivered using free teleconference Apps, caregivers were actively
27 involved, interviews and counselling were performed as usual. Teleconsultations included standard, but
28 adapted measurements and evaluations in video and from photos/videos sent in advance according to
29 specific tutorials. During telephysiotherapy, new sets of exercises were defined and recorded as usual.

30 **Main Outcome Measure(s):** We compared the number of services provided in three phases, among them
31 and with corresponding periods in 2018 and 2019: during CONTROL (30 working days) and COVID surge (13
32 days) only usual consultations/physiotherapy were provided, while during TELEMED (15 days) only
33 teleconsultations/telephysiotherapy. If a reliable medical decision was not possible during teleconsultations,
34 usual face-to-face interventions were prescribed. Continuous quality improvement questionnaires were also
35 evaluated.

36 **Results.** During TELEMED, 325 teleconsultations and 882 telephysiotherapy sessions were provided in 15 days.
37 We found a rapid decrease (-39%) of outpatient services from CONTROL to COVID phase ($R^2=0.85$), partially
38 recovered in TELEMED for telephysiotherapy (from -37% to -21%; $p<0.05$), and stabilised for teleconsultation
39 (from -55% to -60%) interventions. Usual face-to-face interventions have been needed by 0.5% of patients.
40 Patients' satisfaction with telemedicine was very high (2.8/3)

41 **Conclusion(s):** Telemedicine is feasible and allows to keep providing outpatient services with patients'
42 satisfaction. In the current pandemic, this experience can provide a viable alternative to closure for many
43 outpatient services while reducing to a minimum the need of travels and face-to-face contacts.

44 [Keywords](#)

45 Telemedicine, telerehabilitation, outpatients, Covid-19, epidemic

46

47 Introduction

48 COVID-19 is spreading all over the world and the World Health Organization declared a pandemic.¹ China
49 faced it with a total quarantine of the affected areas to eradicate the virus.² Italy, and now most of other
50 countries, adopted a partial quarantine to mitigate the epidemic.³ This strategy aims to decrease the heavy
51 impact on the health systems and allow hospitalization and intensive care of the huge number of patients in
52 need, reducing the overall mortality.⁴

53 The COVID-19 emergency is hitting hard not only infected patients but also all the others.⁵ In many countries,
54 outpatient services have been fully closed due to the need of physicians for COVID-19 patients and to reduce
55 the risk of infection due to travels. Consequently, outpatients are on their own and mostly self-managing.
56 This is not acceptable for diseases that can still have sudden, important progressions even in a few months,
57 and even less acceptable in children.⁶ All these could become collateral damages of the COVID-19 emergency.

58 Telemedicine is defined as the exchange of medical information using electronic tools. It has multiple
59 applications and can be used to provide different services, including consultations and physiotherapy.
60 Telemedicine has shown to be effective in specific areas of care, particularly where technology is involved or
61 medical “hands-on” techniques are less important.⁷ To our knowledge, there are no published results about
62 the application of telemedicine to patients with spinal deformities.

63 In front of the sudden COVID-19 emergency in Italy, and the mobility restrictions to the population, to
64 continue to provide our outpatient services (including hands-on physiotherapy and medical evaluations) we
65 have been forced to convert completely to telemedicine, rapidly developing specific ad-hoc solutions. We
66 are not aware of studies about such a total conversion, for neither medical consultations (teleconsultations)
67 nor physiotherapy sessions (telephysiotherapy).

68 The aim of this paper is to report the feasibility and acceptability of telemedicine as a substitute to usual
69 tertiary referral outpatient rehabilitation services. We looked at the numeric impact on services of (1) the
70 COVID-19 surge in Italy and (2) the subsequent complete, immediate and enforced shift to telemedicine
71 (teleconsultations and telephysiotherapy). This will inform present and future emergency situation of total
72 or partial lockdown, as well as other conditions precluding transportations.

73

74 Material and Methods

75 Italy discovered to have an epidemic of COVID-19 under way on February 24th, 2020 and immediately red
76 zones (total quarantine) were imposed close to Milan. This did not reflect straightaway on the services
77 provided, but the weekly crescendo of partial quarantine throughout the country, with closure of schools on
78 March the 2nd and travel restrictions on the 8th drove to a clear drop of services (Figure 1A). This reduction,
79 and the safety needs of patients and health professionals, urged the decision to move all activities of our
80 Institute to telemedicine on the same day of Prime Minister’s decree to shut down all commercial activities
81 (March 11th). On the 16th, all usual face-to-face services were stopped, unless required following
82 telemedicine.

83 The setting is a tertiary referral outpatient rehabilitation institute for spinal deformities, specialised on
84 pediatric health conditions. The institute usual services include face-to-face consultations,⁸ physiotherapy
85 (evaluation, exercises teaching, cognitive-behavioral approach and counselling)⁹ and psychological sessions,
86 with brace fitting provided in orthotics facilities.¹⁰ Starting from a few previous telephysiotherapy feasibility
87 experiences, we developed in a few days and started in emergency brand-new protocols, by discussion and
88 consensus among the most experienced physiotherapists and physicians. The protocols were discussed and
89 agreed on by all the other professionals in 2 meetings, that were repeated weekly during the study.
90 Supervision was provided to all professionals. A few adaptations to the original protocol were performed in
91 the first week.

92 The telemedicine service has been offered to all our patients aged between 3 and 18. For this analysis, we
93 retrospectively included all services provided from January 7th, 2018 to April 3rd, 2020. Telemedicine
94 interventions (Table 1) have been delivered using free teleconference Apps (Skype™, Whatsapp™ and Google
95 Meet™ software). We provided patients written/video tutorials describing how to collect photos/videos of
96 clinical evaluations, imaging and/or of exercises using home tools (rulers and goniometers). These were
97 received before the telemedicine sessions. All telemedicine sessions lasted as long as usual. Clinical history,
98 conclusions and counselling were performed as usual. Teleconsultations innovations included measurements
99 of the photos/videos previously provided using the software SurgiMap™, that were confirmed by “live”
100 measurements repetition under direct medical guidance. Telephysiotherapy sessions innovations included
101 teaching of exercises using the hands of parents under physiotherapist guidance, and the usage of normal
102 house furniture as treatment tools.

103 We considered 3 phases: (1) CONTROL: usual services prior to discovery of COVID-19 spread (creation of “red
104 zones”), 30 working days (January 7th to February 23rd); (2) COVID: Impact of COVID-19 surge on usual services
105 before starting telemedicine, 13 working days (February 24th to March 14th); (3) TELEMED: services provided
106 only in telemedicine, 15 working days (from March 16th). During CONTROL and COVID the Institute provided
107 only usual consultations and physiotherapy, while during TELEMED only telemedicine services
108 (telephysiotherapy and teleconsultations). If a reliable medical decision was not possible during
109 teleconsultations, physicians prescribed usual face-to-face interventions. Continuous quality improvement
110 questionnaires were also evaluated.

111 Satisfaction with services provided was evaluated at the quality continuous improvement questionnaires,
112 while all professionals were closely monitored throughout the period with supervision, and email
113 consultations. At the end of the study period they were asked to send their positive and negative comments
114 on the experience.

115 The variation of the provided services in total, and in 2 groups (physiotherapy and consultations, the last
116 divided in 3 sub-groups: first visits, follow-ups and brace checks) were compared in the 3 phases among them
117 in 2020, and with the same periods in the years 2018 and 2019. We considered the explanatory categorical
118 3-level variables years and phases. We checked differences between and within the variables through a two-
119 way ANOVA, a post hoc analysis with Scheffe correction for significant differences, and marginal means. We
120 also performed a regression analysis within each phase to check the influence of days on services provided.
121 We used STATA 15 and Excel.

122

123 Results

124 During TELEMED, in 3 weeks (15 working days), 12 physicians and 38 physiotherapists provided 1,207
125 interventions (325 teleconsultations, 882 telephysiotherapy sessions). We found in 2020, but not in 2018 and
126 2019, a rapid decrease of outpatient services in COVID phase (-39%) in both groups (-37% physiotherapy
127 sessions, -55% consultations). We also found differences among phases in 2020 (Table 2): comparing to the
128 great losses from CONTROL to COVID, during TELEMED physiotherapy recovered (from -37% to -21%;
129 $p < 0.05$), while consultations did not. For consultations there were differences among sub-groups: follow-up
130 teleconsultations stabilised (from -55% to -60%), while first visits (from -34% to -89%) and brace checks (from
131 -16% to -75%) almost disappeared (Figure 1B). The regression describes well the day-by-day effect of COVID-
132 19 and telemedicine within the phases: all services and physiotherapy subgroup decreased in COVID phase
133 ($p < 0.01$; $R^2 = 0.85$ and 0.62 , respectively), and consultations increased in TELEMED ($p < 0.05$; $R^2 = 0.31$) (Figure
134 1C). During TELEMED, 0.5% of patients were required by physicians, after the teleconsultation, to move from
135 home to reach our Institute for a usual face-to-face consultation.

136 Quality continuous improvement questionnaires (response rate 38%) reported a mean satisfaction of 2.8 out
137 of 3. All physicians and therapists have been very happy with their experiences, confirming that it was
138 possible to work properly. Those less used to technology declared surprise and great satisfaction with the
139 services delivered.

140

141 Discussion

142 The sudden surge of COVID-19 in Italy created an ideal experimental setting for telemedicine. Our Institute
143 provided only usual face-to-face services until March 14th. From March 16th, only telemedicine was
144 provided, and face-to-face consultations were possible only if required by a physician as a result of the
145 teleconsultation. Consequently, the reduction of number of services provided by the Institute shows the
146 difficulty of patients with usual outpatient services during the pandemic in Italy. Even before the total
147 lockdown (March 11th), there was a clear, progressive and continuous reduction during the COVID phase.
148 Conversely, when the Institute moved completely to telemedicine, the recovery (even if not at the previous
149 level) documents the value and feasibility of telemedicine for patients and professionals, particularly in
150 emergency situations. Patients were satisfied according to the quality questionnaires, and all professionals
151 were interviewed declaring their satisfaction. Physicians felt comfortable with the teleconsultations' results,
152 and required a face-to-face consultation, with consequent travelling to reach our facilities, for only 1 patient
153 out of 200.

154 The COVID-19 pandemic started in China currently has its epicentre in Europe and it's quickly spreading. Italy
155 was the first country hardly struck by COVID-19 after China, with the Public Health System struggling to react.³
156 Outpatient services were shut down to move the staff to COVID-19 services. In previous epidemic
157 emergencies, a dramatic reduction of public services has been documented too.⁹ Nevertheless, this
158 pandemic is posing unique challenges to the health systems worldwide. It is clear that a major need is to
159 guarantee a continuum of care to other patients unaffected by the virus, while at the same time protecting
160 them from possible contact with it, avoiding travels and access to health facilities.

161 Despite the unavoidable limits due to its observational nature and the use of an historical control, this first
162 study shows the possibility to completely transform also classical "hands-on" outpatient services to
163 telemedicine in the COVID-19 emergency. In this way, we reduced below 1% the needs for travels and access
164 to health facilities for patients, and zeroed travels of health professionals. This experience can provide a
165 viable alternative for many outpatient services, avoiding their closure with the consequent impact not only
166 on patients' health but also economical on professionals and facilities.

167 The current study has limitations but also strengths. It has high ecological validity: real life, a whole institute,
168 over 1,200 interventions; it is unique: the pandemic allows to study emergency situations, the sudden total
169 change of all activities offers insight on feasibility and acceptability in these circumstances. There are risks of
170 selection bias: patients feeling urgent need for consultations, or more severe cases could have been more
171 prone to telemedicine; the digital divide (no available technology, Internet connections or digital knowledge)
172 can have precluded a specific population to access the services; some patients cancelled the session because
173 they did not feel comfortable in the preparation phase (Table 1). Moreover, patients accessing telemedicine
174 could have been more inclined to technology and/or worried for their clinical conditions: this could have an
175 impact on patients' satisfaction. Future studies with longer follow-up period will provide more complete data
176 and will allow to check the effectiveness of the services provided in telemedicine.

177

178 **Conclusion**

179 Telemedicine is feasible and allows to keep providing outpatient services with patients' satisfaction. In the
180 current pandemic, this experience can provide a viable alternative to closure for many outpatient services
181 while reducing to a minimum the need of travels and face-to-face contacts.

182

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186

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226 Captions

227 Figure 1. (A) Evolution of outpatient services provided from January 7th, 2018 to March 28th, 2020. Vertical
228 lines refer to the start of observation periods: COVID-19 emergency (February 24th), start of telemedicine
229 services (March 16th). Sudden and important changes (decrease and increase, respectively) can be seen, with
230 a slight delay for consultations. Grey: total of services; blue consultations; orange physiotherapy. (B)
231 Descriptive analysis of the observations performed through a polynomial function of 3rd degree. (C) Evolution
232 during the days of services (grey), consultations (blue) and physiotherapy (orange) in COVID-19 and
233 telemedicine phases.

234 Table 1. Differences between usual (consultations and physiotherapy) and telemedicine (teleconsultations
235 and telephysiotherapy) interventions.

236 Table 2. Average variations (ANOVA) in services provided in the studied phases, including consultations and
237 physiotherapy subgroup. During CONTROL and COVID only usual consultations and physiotherapy were
238 provided, while during TELEMED only teleconsultations and telephysiotherapy – see text for more details.

239