



# Telemedicine-assisted care of an older patient with COVID-19 and dementia: bridging the gap between hospital and home

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## Abstract

Hospital at Home (HaH) has been proposed as a solution to relieve pressure on hospital beds during the COVID-19 pandemic; however, caregivers' feelings of inadequacy and concerns on the need for tighter clinical monitoring might lead to unnecessary and potentially harmful hospital admissions in frail older patients with mild or atypical COVID-19. Here we report the case of a 91-year old woman with severe dementia and atypical COVID-19 that could be successfully managed by our HaH thanks to her highly motivated caregivers and the support of a telemedicine solution (TMS) to provide caregiver training and support as well as supplementary telemonitoring. Despite some well-known issues on TMS use, the hybrid in-person and tele-visit approach of TMS-assisted HaH could help to create a "secure" environment, empowering caregivers to manage frail older adults with COVID-19 at home, avoiding unnecessary admissions to closed wards and their negative physical, functional and psychological outcomes.

**Keywords** Hospital at home · Caregiver education · Telemedicine · COVID-19 · SARS-CoV-2

During the COVID-19 pandemic, healthcare systems worldwide have striven to address the increasing and diverse needs of SARS-CoV-2 infected patients, while minimizing exposure of uninfected patients and healthcare workers [1]. The difficulties in managing high numbers of older subjects in the community, combined with caregivers' fears, have led to the hospitalization of many mild or asymptomatic patients, at risk of sudden clinical deterioration not much because of COVID-19 itself but because of frailty and hospital-related adverse events such as delirium, reduced mobility, and social isolation [2, 3]. Hospital at Home (HaH) is an alternative healthcare model that provides hospital-level care to acutely ill frail subjects in their home and has been proven as a safe and effective alternative for selected patients with a variety of conditions [4, 5]. Hospital at Home has been proposed as a solution to relieve pressure on hospital beds and reduce

personal protective equipment (PPE) use and SARS-CoV-2 exposure [6]. Proposed solutions varied from expansion of services for uninfected subjects [7] to rapid development of monitoring services for low risk COVID-19 patients, with the possibility to escalate care intensity either at home [7, 8] or in-hospital [9–11].

Throughout the pandemic, the HaH service of Città della Salute e della Scienza di Torino - Molinette Hospital, Northern Italy, kept providing acute home care to frail older patients with conditions ranging from decompensated heart failure to advanced onco-hematological diseases and dementia. Unlike hospital wards, the HaH setting has been open to caregivers and family members and thus required ad hoc safety protocols, including routine SARS-CoV-2 testing on naso-pharyngeal swabs (NPS) for all admitted patients, irrespective of hospitalization cause [1, 6]. Several asymptomatic or atypical COVID-19 cases were thus identified [12], most of them transferred to COVID-19 wards because of family feelings of inadequacy and concerns on the need for tighter clinical monitoring. Here, we report one of such atypical COVID-19 cases that we were able to successfully manage at home thanks to her highly motivated caregivers and the support of a telemedicine solution (TMS).

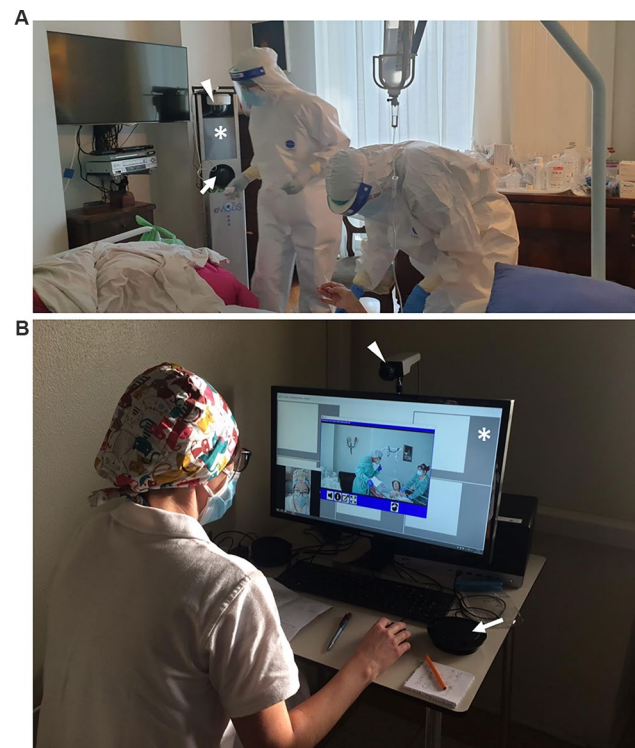
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In November 2020, a 91-year-old woman affected by severe dementia was referred to our HaH because of functional deterioration over the previous 10 days. Relevant comorbidities included hypertension, chronic obstructive pulmonary disease, hypothyroidism, and osteoporosis. Medications included levothyroxine, irbesartan, and quetiapine. No fever, cough, or breathlessness nor contacts with known COVID-19 cases were reported. Before admission, she could eat and walk under supervision, and she interacted with close relatives. On admission, she presented extreme ideomotor apraxia, being unable to walk and speak, and dehydration; swallowing was impaired due to incoordination. Vital signs were normal, including body temperature (36.2 °C) and respiratory rate (18/min). Physical examination revealed reduced breath sounds with some crackles at both lung bases and was otherwise unremarkable. Blood tests (Table 1 in Online Resource) showed a slight increase of inflammatory markers with mild lymphopenia and thrombocytopenia; estimated creatinine clearance was 26.4 ml/min. A Midline catheter was inserted for intravenous fluid support, irbesartan and quetiapine were discontinued. Routine NPS resulted positive for SARS-CoV-2. Bedside ultrasound showed signs of interstitial involvement of the lower right lung (Fig. 2 in Online Resource);  $\text{PaO}_2/\text{FiO}_2$  in ambient air was 290. A shared decision was taken with relatives to continue HaH care to maintain emotional support and prevent potential complications of hospitalization. Use of PPE by noninfected family members was implemented and use of an experimental TMS (TESI eViSuS<sup>®</sup>, Tesi S.p.A, Bra, Italy) was accepted by the patient's family. This TMS was readily available because of an approved but temporarily suspended trial on caregiver education; its characteristics have been previously described [13]: a remote patient station communicates with a hospital-based control station through a privacy-compliant mobile network, allowing real-time, bidirectional, audio–video transmission (Fig. 1). Besides daily in-person nurse and physician visits, nurses provided TMS-based caregiver training sessions on infusion management as well as supplementary telemonitoring. When clinical stability was achieved, nurse-led televisits were arranged twice daily to monitor patient recovery (including swallowing ability, hydration status and mobilization) and caregiver-measured vital signs; additional visits were performed when necessary. Eventually, the patient's premorbid status was restored, and she could interact through the TMS until her discharge.

To our knowledge, this is the first reported case of the successful management of an oldest old patient with mild atypical COVID-19 in the HaH setting, with the support of a TMS. Larger reports on the impact of HaH management of COVID-19 patients focused on subjects requiring clinical monitoring only [9–11] or provided home care to significantly younger patients without major comorbidities



**Fig. 1** Aspect and use of the telemedicine system. **A** shows Hospital at Home nursing and medical personnel wearing personal protective equipment while providing hospital-level care, including fluid infusion, to the patient. On the background, the remote station, featuring an operator-controlled high-definition camera with built-in optical and digital zoom (arrowhead), a touchscreen monitor (asterisk) and speakerphone (arrow). **B** shows Hospital at Home personnel using the control station to monitor the patient's condition communicating with caregivers through a high-fidelity monitor (asterisk), webcam (arrowhead), and speakerphone (arrow). Televisits are prompted by the control station and accepted by the remote station to ensure privacy. The control station allows to control multiple televisits simultaneously

or functional impairment [7, 8]. Most of these experiences relied on the support of TMS, ranging from simple telephone calls [9, 10] to tele-visits and video calls [7, 8, 11], also featuring patient-reported parameters through dedicated apps [8, 11].

To effectively manage frail, older patients with complex care needs (with or without mild COVID-19) at home, a careful selection of cases, including their environmental and social conditions to ensure patient's and family safety, is mandatory [4, 6]. In this context, TMS can support HaH management enabling patient monitoring and caregiver support and education, at the same time reducing unnecessary in-person visits, PPE consumption and personnel exposure to SARS-CoV-2 [6, 11]. However, in the acute care setting, some well-known issues on the use of TMS need to be carefully considered [11]. First, only highly motivated caregivers can overcome the initial reluctance and difficulties in the use

of TMS; easy-to-use technologies, well-established training protocols and availability of technical support on demand [9], as well as first in-person evaluation of the individual case [11], might promote successful use of TMS. Besides ethical and legal issues that can be addressed using secure networks [11], safety concerns might include the need to disinfect potentially contaminated TMS instruments and the SARS-CoV-2 exposure of family members of non-autonomous patients [6]. However, HaH personnel could remotely monitor health status and parameters of all family members, thus increasing TMS cost-effectiveness and safety, as well as providing instructions for correct PPE use and isolation protocols. Other practical issues might include the lack of adequate mobile networks in rural areas or in the context of old housing with thick walls, that could hinder the use of sophisticated technologies such as that presented in our case. A wider adoption of TMS in the HaH setting would necessarily require a model reorganization, to ensure prompt response and cost-effective management of patients, including dedicated personnel to provide group education sessions and low-intensity high-volume post-acute patient monitoring, that could be recruited from recently retired and immunosuppressed personnel [9]. In our case, a relatively advanced and expensive TMS was deployed due to convenience reasons; however, such solution would be more indicated in other settings such as nursing homes or for a limited timeframe in complex cases. Integrated home care models with different levels of care intensity and of TMS complexity would increase the number of older subjects that could be effectively managed by the HaH while increasing cost-effectiveness [7, 8, 11].

Lastly, the absence of physical presence and contact could also be an issue when implementing TMS in older people's care, both from a clinical and psychological point of view; however, several humanistic practices have been proposed to help healthcare workers to establish meaningful relationships with patients and caregivers during TMS visits [14].

In conclusion, the hybrid in-person and tele-visit approach of TMS-assisted HaH could help to create a "secure" environment by addressing self-confidence and safety issues, thus empowering motivated caregivers to manage frail older adults with COVID-19 at home, avoiding unnecessary admissions to closed wards and their negative physical, functional, and psychological outcomes.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s40520-021-01875-2>.

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## Declarations

**Conflict of interest** A.O.U. Città della Salute e della Scienza di Torino (Turin, Italy), Università degli Studi di Torino (Turin, Italy), and Tesi S.p.A. (Bra, Italy) were among the partners of a Syndicate Association (Associazione Temporanea di Scopo—ATS in Italian) for the sole purpose of bringing forward the CANP Project. In this context, Tesi S.p.A. provided the TMS, and any technical support needed. The funding source and Tesi S.p.A. had no role in the design, methods, subject recruitment, data analysis, interpretation of data, manuscript preparation, and decision to submit the present article for publication. All individual authors report no relevant personal conflicts of interest.

**Statement of human and animal rights** The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Use of the experimental telemedicine system was approved by the local Ethics Committee as detailed in the text.

**Informed consent** The patient's son gave written informed consent for himself and as a proxy of the patient to the experimental use of the TMS to support patient's monitoring and care and to provide caregiver education in the context of a traditional HaH stay, and to the publication of this paper, including photographs.

## References

1. Bo M, Brunetti E, Presta R et al (2020) To keep a COVID-19-free hospital ward: mission possible? *Aging Clin Exp Res* 32:1627–1628. <https://doi.org/10.1007/s40520-020-01640-x>
2. Marengoni A, Zucchelli A, Grande G et al (2020) The impact of delirium on outcomes for older adults hospitalised with COVID-19. *Age Ageing* 49(6):923–926. <https://doi.org/10.1093/ageing/afaa189>
3. Bielza R, Sanz J, Zambrana F et al (2020) Clinical characteristics, frailty, and mortality of residents with COVID-19 in nursing homes of a region of Madrid. *J Am Med Dir Assoc* 22:245–252. e2. <https://doi.org/10.1016/j.jamda.2020.12.003>
4. Shepperd S, Iliffe S, Doll HA et al (2016) Admission avoidance hospital at home. *Cochrane Database Syst Rev* 9:CD007491. <https://doi.org/10.1002/14651858.CD007491.pub2>
5. Isaia G, Astengo MA, Tibaldi V et al (2009) Delirium in elderly home-treated patients: a prospective study with 6-month follow-up. *Age (Dordr)* 31:109–117. <https://doi.org/10.1007/s11357-009-9086-3>

6. Bryant PA, Rogers BA, Cowan R et al (2020) Hospital-in-the-Home Society Australasia. Planning and clinical role of acute medical home care services for COVID-19: consensus position statement by the Hospital-in-the-Home Society Australasia. *Intern Med J* 50:1267–1271. <https://doi.org/10.1111/imj.15011>
7. Heller DJ, Ornstein KA, DeCherrie LV et al (2020) Adapting a hospital-at-home care model to respond to New York City's COVID-19 crisis. *J Am Geriatr Soc* 68:1915–1916. <https://doi.org/10.1111/jgs.16725>
8. Sitammagari K, Murphy S, Kowalkowski M et al (2020) Insights from rapid deployment of a “virtual hospital” as standard care during the COVID-19 pandemic. *Ann Intern Med* 174(2):192–199. <https://doi.org/10.7326/M20-4076>
9. Nogués X, Sánchez-Martinez F, Castells X et al (2021) Hospital-at-home expands hospital capacity during COVID-19 pandemic. *J Am Med Dir Assoc*. S1525-8610(21)00139-0. <https://doi.org/10.1016/j.jamda.2021.01.077>
10. Ryan PP, Hawkins KL, Altman S et al (2020) A novel virtual hospital at home model during the coronavirus disease 2019 (COVID-19) pandemic. *Infect Control Hosp Epidemiol* 1–3. <https://doi.org/10.1017/ice.2020.435>
11. Silven AV, Petrus AHJ, Villalobos-Quesada M et al (2020) Telemonitoring for patients with COVID-19: recommendations for design and implementation. *J Med Internet Res* 22:e20953. <https://doi.org/10.2196/20953>
12. Isaia G, Marinello R, Tibaldi V et al (2020) Atypical presentation of Covid-19 in an older adult with severe Alzheimer disease. *Am J Geriatr Psychiatry* 28:790–791. <https://doi.org/10.1016/j.jagp.2020.04.018>
13. Viglino G, Neri L, Barbieri S et al (2020) Videodialysis: a pilot experience of telecare for assisted peritoneal dialysis. *J Nephrol* 33:177–182. <https://doi.org/10.1007/s40620-019-00647-6>
14. Zulman DM, Verghese A (2021) Virtual care, telemedicine visits, and real connection in the era of COVID-19: unforeseen opportunity in the face of adversity. *JAMA* 325:437–438. <https://doi.org/10.1001/jama.2020.27304>

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