

## Telemedicine in COVID-19 era: Lessons from Online Co-management of Bone Marrow Transplant Patients

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Recently, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has infected millions of people globally and killed hundreds of thousands. Until an effective vaccine is available, prospects of definitive control of the COVID-19 pandemic are uncertain. In fact, over 50% of the infection is being spread by asymptomatic individuals.<sup>1,2</sup> Both mortality and admissions to intensive care units have increased several folds over baseline seasonal rates in most severely affected regions.

Pakistan might be particularly vulnerable to the COVID-19 pandemic for several reasons. The first and foremost reason is difficulty in maintaining social distancing, which is regarded as a critical prevention strategy, as many Pakistani communities live together in close quarters. Moreover, Pakistan has only 1.5 critical care beds per 100,000 population compared to 3.6 in China, 12.5 in Italy or 9.7 in Spain, respectively.<sup>3,4</sup> These proportions refer to physical beds and equipment, and, most importantly, to skilled personnel. In Italy, a country severely affected by this pandemic with over 30,000 deaths, more than 160 health care workers died of COVID-19, 80% of them being physicians.<sup>5</sup> Some of these doctors were general practitioners acting solo, but, most importantly,

physicians tend to be older males as opposed to nurses who are often young women and thus at decreased risk of morbidity and mortality from COVID-19.<sup>6</sup> Clearly, tools capable of minimizing direct patient contact without compromising quality of care are direly needed.

The potential for information and communication technology to promote effective remote intensive care has been documented, at least in high-resource settings.<sup>7</sup> The Cure2Children Foundation, an International Italian NGO also registered in Pakistan, has extensively applied a cloud-based platform for co-management of children undergoing bone marrow transplantation (BMT). This procedure often requires prolonged sub-intensive to intensive care, in the Indian subcontinent.<sup>8</sup> Since 2008, close to 700 bone marrow transplants have been performed. Of these, 170 were carried out at the Children's Hospital, Pakistan institute of Medical Sciences (PIMS) and at Dr Akbar Niazi Teaching Hospital (ANTH) in Islamabad, Pakistan. These transplants were performed primarily in low-risk patients with hemoglobinopathies by local physicians and nurses with no previous BMT experience but assisted by daily online interactions with condition-specific BMT experts.<sup>9</sup> The IT system employed provided several tools including pre-transplant check lists, electronic medical record, direct connection to HL7-compliant patient monitors, automatic patient-specific treatment plans, continuing quality improvement tools, inventory and cost monitoring.<sup>8</sup> The quality improvement tools

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included drug and transfusion administration tracking, incident reporting, clinical practice guidelines, standard operating procedures, and real-time outcome analysis.<sup>8</sup> Outcomes were not substantially different from those reported in high-resource settings in a comparable patient group.<sup>10</sup>

This proof of principle is potentially quite relevant to the current COVID-19 pandemic, in as much as it shows how the physical presence of experienced physicians, presumably the ones most difficult to recruit and at highest mortality risk, may not be an absolute requirement. In fact, in units taking care of complicated patients with a single disease and a limited number of protocols and procedures which are thus amenable to focused training, professionally trained and properly supported nurses along with junior doctors can provide adequate care with online support from experienced physicians. The obvious consequence of this is the possible huge expansion of a flexible workforce of remote consultants with condition-specific expertise. Pandemics may come in asynchronous waves in different regions: for example, while it is peaking in Pakistan and India it may be subsiding in China, UK or Italy and very experienced professionals from the latter countries may be available for online consultation.<sup>11</sup> This approach may also have substantial cost-containment implications. Data centralization offered by a cloud-based IT platform will allow quick access for analysis, centralized protocols, and procedures and, most importantly, coordinated allocation of resources, real-time reliable medical data and well-designed clinical studies.

Remote co-management models may also be relevant to future public health emergencies, including natural disasters. The experience with Fangcang shelter hospitals in China suggests that the rapid implementation of scalable and properly designed and equipped physical spaces is feasible<sup>12</sup> and that the bottle neck to timely scalable care

might primarily be the lack of availability of skilled personnel.

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