



## Telehealth: “virtual” lifeline for home-ventilated patients during the COVID-19 pandemic

To the Editor:

The evolution of positive airway pressure (PAP) devices since their introduction by Colin Sullivan in 1980 has witnessed growing evidence supporting their use for medical conditions associated with chronic ventilatory failure. The emergence of PAP devices also resulted in a higher number of patients requiring long-term medical care and ventilation. The concept of “hospital at home” with home ventilation to ease the burden on overwhelmed hospitals was evident when the prevalence of home mechanical ventilation (HMV) users reported in 2016 was at 10.9 per 100 000 population [1].

HMV support generally comprises a mobile healthcare team (HCT), which delivers services to the patient at their homes or long-term care facility. Depending on local practices, these teams usually consist of HMV-trained physicians, nurses and rehabilitation therapists.

With the global pandemic of COVID-19, implementation of social lockdowns and restrictions on movement has led to the suspension of many essential medical services and strains in the healthcare system. Hospital admissions for non-COVID-19 patients are curtailed to reallocate beds for the surge of COVID-19 patients. Crucial interventions for HMV patients such as polysomnography, ventilator titration, speech therapy, dietary consultation and rehabilitation interventions were forced to cease due to logistic or infection control considerations. The pandemic has also caused disarray in the transition process for patients from hospital to home, and home visits by HCTs were interrupted.

To date, a considerable proportion of HMV cases requires noninvasive ventilation (NIV). Despite increasing evidence of its use, various studies have demonstrated that the usage of NIV in Asia is far from optimal, both in hospital and domiciliary settings [2]. The use of telehealth to remotely manage HMV is virtually nonexistent. Many less-developed countries are still content with conventional physical home visits to deliver HMV services.

One key factor identified is the disparity in the advancement of science and technology. Less-developed countries often face constraints in resources (equipment and staffing). Delay in the introduction of new technology to less-developed countries is also not uncommon [3]. Besides, the lack of a standardised telehealth and HMV implementation, patient data confidentiality legislation and the uncertainty in health insurance coverage are other conundrums faced. In Asia, the socioeconomic conditions are quite heterogenous across different countries, and the acceptance of new technology is also varied compared to patients of other regions [3]. However, given the constraints faced during the pandemic, the prospect of utilising telehealth in this field has gained considerable momentum.

Telemedicine refers to the provision of clinical services. In contrast, telehealth is an umbrella term that encompasses telemedicine and the distribution of nonclinical services such as medical information and provider training [4]. Through information and communications technology, telehealth provides a network link to enable remote collaboration between the patient or their caregivers and HCTs, who are geographically separated.



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**Telehealth appears useful to fill in the void for home-ventilated patients to maintain the much-needed connectivity with their healthcare team during the #COVID19 pandemic**

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The primary concern with HMV support is the ventilation of the patients. Monitoring can be done through a cloud-based system (Care Orchestrator, Phillips Respironics or AirView, Resmed), which transmits information from the home ventilators and vital signs monitoring devices. HCTs can remotely review (*via* a securely registered account) the patterns of usage, titrate and adjust patients' ventilator setting to optimise ventilation delivery and ensure good compliance [5, 6]. Alarming health information can be captured by the software and highlighted for the attention of the HCT. From a legal perspective, telehealth may have potential security pitfalls, and this remains a concern [7]. Nevertheless, many service providers have improved their security features, such as having full data encryption during data transmission, and necessitating user authentication on their platforms. Attempts have also been made to comply with regulations of various government legislation to ensure patient confidentiality and the protection of medical data [4].

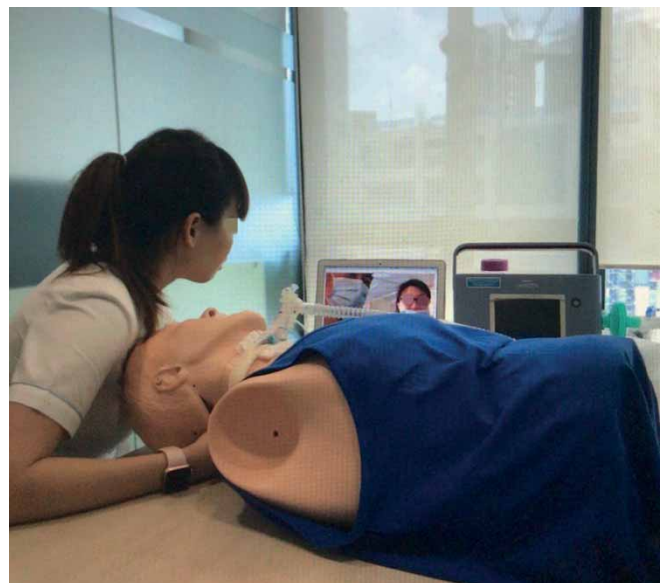
Many mobile applications for telehealth also have an enormous impact on the management of HMV patients. Using common web-based platforms that provide video calls and instant messaging functions, HCTs can address the patients' and caregivers' concerns (whether general or psychosocial) directly and guiding them to make necessary adjustments in the treatment plans. This option is crucial in enhancing patients' or caregivers' competency, especially for newly recruited ventilator users. The urgency of a required in-person or hospital assessment can also be preliminarily determined (triage process) to prioritise workload and avoid an unnecessary visit to the hospital [8].

Through telehealth, simulated real-time coaching or uploaded web-based self-learning modules may provide patients and caregivers with the knowledge and skills to manage specific needs required by the HMV patients (figure 1). This includes management of secretion, dietary intake, care for pressure sores, limb physiotherapy, as well as monitoring of abnormal urine or bowel clearance. Besides, telehealth can also be immensely beneficial when integrated with care programmes supported by advanced practice nurses when faced with limited numbers of healthcare providers [9].

Despite its feasibility, the adoption of telehealth during the pandemic has witnessed several challenges. The HCT, as well as the patients or caregivers, are mostly unfamiliar with the technology and the relevant communication interface [10]. In addition, not all members of the HCT had received adequate training to achieve proper competency, especially in dealing with unexpected emergencies. On the other hand, some patients still require in-person care provided by the HCT, for example exchanging of indwelling catheters, monitoring of blood electrolytes and gases.

On the other hand, some long-term challenges include setting up an effective follow-up care plan, a secure data storage system and getting manufacturers to provide regular and reliable maintenance for their equipment and accessories.

Therefore, to effectively adopt this new approach, three essential fundamentals should be observed: 1) ensure reliability in the technology and its platform; 2) proper training should be made compulsory to



**FIGURE 1** A home ventilation nurse providing online training to caregivers to manage home mechanical ventilation *via* a tracheostomy tube (image courtesy of Tan Tock Seng Hospital Home Ventilation and Respiratory Support Service).

all parties involved; and 3) policy-makers need to draw up acceptable legislation to facilitate telehealth towards its objective in supporting HMV services.

The number of HMV patients is increasing rapidly worldwide. This trend is adding burden to existing healthcare resources, and COVID-19 has exacerbated this strain. Although telehealth appears attractive as an alternative or complement to the conventional HMV patient care, it remains unexplored, especially in Asian countries. Future research is sorely needed to determine the feasibility and effectiveness of telehealth for HMV patients.

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## References

- 1 Macintyre EJ, Asadi L, McKim DA, *et al.* Clinical outcomes associated with home mechanical ventilation: a systematic review. *Can Respir J* 2016; 2016: 6547180.
- 2 Guan L, Zhou L, Song L, *et al.* Challenges to and opportunities for the implementation of non-invasive positive pressure ventilation in the Asia-Pacific region. *Respirology* 2019; 24: 1152–1155.
- 3 Borel JC, Palot A, Patout M. Technological advances in home non-invasive ventilation monitoring: reliability of data and effect on patient outcomes. *Respirology* 2019; 24: 1143–1151.
- 4 World Health Organization. Telemedicine, Telehealth, and Health Information Technology (An American Telemedicine Association Issue Paper). [www.who.int/goe/policies/countries/usa\\_support\\_tele.pdf](http://www.who.int/goe/policies/countries/usa_support_tele.pdf) Date last accessed: June 9, 2020. Date last updated: May 2006.
- 5 Ambrosino N, Vitacca M, Dreher M, *et al.* Tele-monitoring of ventilator-dependent patients: a European Respiratory Society Statement. *Eur Respir J* 2016; 48: 648–663.
- 6 Mansell SK, Cutts S, Hackney I, *et al.* Using domiciliary non-invasive ventilator data downloads to inform clinical decision-making to optimise ventilation delivery and patient compliance. *BMJ Open Respir Res* 2018; 5: e000238.
- 7 Stanberry B. Legal and ethical aspects of telemedicine. *J Telemed Telecare* 2006; 12: 166–175.
- 8 Gates B. Responding to Covid-19: a once-in-a-century pandemic? *N Engl J Med* 2020; 382: 1677–1679.
- 9 Rutledge CM, Haney T, Bordelon M, *et al.* Telehealth: preparing advanced practice nurses to address healthcare needs in rural and underserved populations. *Int J Nurs Educ Scholarsh* 2014; 11: 1–9.
- 10 Hernandez C, Mallow J, Narsavage GL. Delivering telemedicine interventions in chronic respiratory disease. *Breathe* 2014; 10: 199–212.