

# Revisiting electronic systems and gadgets for patient management in COVID-19 Intensive Care Units

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## Abstract

Monitoring and highly sophisticated care of the Covid-19 pandemic patients has taught us many new lessons. The ever-changing management strategies and the therapies for the disease containment is one aspect of the wide spectrum of innovations and refinements, which were the result of global effort by the scientists and the healthcare workers; the self-protection of front-line workers soon became immensely important to save them from contracting the disease and thus prevent rapid reduction in their numbers. Personal protective measures were vehemently enforced and means and measures to reduce (if not eliminate) direct contact with the known as well as yet unknown Covid positive patients were advocated. Different countries adopted different measures according to their customs and resources, but all with the same purpose. This paper is written to highlight the same and present our approach at our center.

**Key words:** COVID-19; Monitoring; Surveillance; Intensive Care; Gadgets

**Citation:** Poonurapampil JA, Karim HMK, Varghese AR. Revisiting electronic systems and gadgets for patient management in COVID-19 Intensive Care Units. *Anaesth. pain intensive care* 2021;25(1):5–7; DOI: 10.35975/apic.v25i1.1370

**Received:** 11 October 2020, **Reviewed & Accepted:** 25 November 2020

## 1. Introduction

The World Health Organization declared coronavirus disease of 2019 (COVID-19) as a global health crisis (pandemic) on 11th March 2020.<sup>1</sup> With the second wave of the viral pandemic in full swing now, the healthcare workers (HCWs) have been at risk of getting exposed to COVID-19 while caring for such patients. However, it is imperative to not only maintain a pool of healthy HCWs available for the patient care, but also to prevent the inadvertent spread of disease by asymptomatic carriers. Patients admitted to Intensive Care Units (ICU) need comprehensive monitoring due to the inherent characteristics and severity of their

disease. While prolonged, and repeated close contact and exposure is largely unavoidable in an ICU, but it can be reduced by incorporating a few gadgets and technologies into day-to-day practice. We share our experience and opinion on this subject.

## 2. Video surveillance

Also known as closed-circuit television, in which, cameras are placed near the bedside and are linked to one screen outside the ICU for continuous remote surveillance of the patient activity and the condition. The major upside of this is remotely observing the patient throughout the day and even at night, without

disturbing the patients. This system is also helpful in monitoring the accidental removal or displacement of high flow nasal cannula, non-invasive ventilation masks, and non-rebreathing face masks. The patients who are irritable, have delirium and in-adequate sedation, may remove masks, try to self-harm, or accidentally get harmed. They can be observed and potential catastrophe may be averted. The shortcomings of video surveillance include loss of patient confidentiality and privacy, concerns regarding data storage and retrieval, and legal liabilities.<sup>2</sup> It can be upgraded to a portable, two-way audio-visual system for better communication between the patients who can communicate, high dependent unit patients, and among the HCWs. It can also be combined with telemetry and cloud computing, to gain a better understanding of patients' status and improve patient safety, while they are in quarantine centers.<sup>3</sup>

### 3. Smartphones

Smartphones are ubiquitous devices capable of several functions. In our setting a common, dedicated smartphone was used for report collection and rapid communication by creating separate WhatsApp groups; one for the radiology department to share images and another for the microbiology department for COVID reports, etc. Separate groups were also created for each cadre of HCWs for real-time, rapid updates.

Interdepartmental consults were done via e-mail, accessible on the phone and desk-top. Moreover, complex clinical communications were possible via voice calls or voice messages. The mobile phones were also used to counsel and inform family members daily, of the patient's clinical condition. The counselling and information were provided by both doctors and public relations officers/medical social workers. Despite personnel in the COVID-19 ward changing regularly, the dedicated phone number made contact easier and reduced confusion for non-COVID-19 personnel. Even patients, who could use their mobile phones, were allowed to use their phones/smartphones to communicate with HCWs via text messages or phone calls through the dedicated number. However, mobile phones also their limitations such as a lack of confidentiality. Using smartphones may also worsen inter-professional

relationships, increase interruptions, and reduce broader verbal discussions about patient care.<sup>3</sup>

### 4. Handheld transceiver

It is commonly called a walkie-talkie; it has a speaker and a microphone, and is used for two-way audio communication with the push of a button. One unit was placed with the HCWs working inside the ICU. Since it is portable it was carried by the HCWs, who could transmit even complex medical information from anywhere in the ICU. The other unit was kept outside the ICU at the central station for easy access by any cadre of HCWs. Benefits include portability and real-time audio communication independent of mobile network connectivity. The downside of this device is that unlike a telephone it does not permit simultaneous two-way communication and is not handsfree. Moreover, it causes more electromagnetic interference with medical equipment than mobile phones.<sup>4</sup>

### 5. Microphone and speaker systems

It is a fixed speaker and microphone system that allows for two-way communication. One unit was placed outside the ICU and the other unit was placed inside the ICU. It allows for handsfree communication across the closed ICU doors, especially when the use of walkie talkie was not possible for example during doffing or some ongoing procedure. HCWs can observe the ongoing procedure and advice as required from outside. The main drawback is that the system is fixed and not portable. The communications can be heard by anyone in the vicinity, so there is no privacy or confidentiality, thus patient data should not be shared over the intercom.

### 6. Central monitoring system

In this, multiparameter monitors of different patients are linked so that each patient's vital sign is displayed simultaneously, in real-time on a single screen. The main advantage of remote telemetry, especially while managing patients with infectious diseases like COVID-19 is the reduction in avoidable exposure and thus, the possibility of HCWs being infected is

reduced<sup>5</sup> Moreover, there is an increase in productivity among nursing staff as more time is available for patient care.<sup>6</sup> However, there must be constant and dedicated monitoring of all patients' vital signs and no alarm should be ignored. Discrepant values may be displayed due to equipment problems like faulty ECG leads or displaced pulse oximeter, etc. High costs in setting up and maintenance are a hurdle for widespread application.<sup>7</sup> Although these systems are relatively costly, on the background of a severe scarcity of HCWs, a prevalence of more than 21% infection in HCWs in the United States by April 2020,<sup>8</sup> and a hazard ratio of 11.61 (95% confidence 10.93–12.33) among HCWs compared to community people,<sup>9</sup> the benefit expected outweighs the cost concern.

## 7. Conclusion

In conclusion, to keep the health system up and running, healthy HCWs are essential and every strategy for risk reduction and mitigation should be deployed. Installation and use of electronic systems and gadgets for patient monitoring in COVID-19 ICU and HDU can reduce the number of direct contacts and improve patient monitoring and safety.

## 8. Conflict of interest

No conflict of interest declared by the authors.

## 9. Authors' contribution

HMRK, ARV- personal experience, literature search and draft write-up, and revision of the manuscript.

HMRK- guarantor of the manuscript.

## 10. References

1. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed.* 2020 Mar 19;91(1):157-160.

- [PubMed] DOI: [10.23750/abm.v91i1.9397](https://doi.org/10.23750/abm.v91i1.9397)
2. Appenzeller YE, Appelbaum PS, Trachsel M. Ethical and practical issues in video surveillance of psychiatric units. *Psychiatr Serv.* 2020 May 1;71(5):480-486. [PubMed] DOI: [10.1176/appi.ps.201900397](https://doi.org/10.1176/appi.ps.201900397)
  3. Dašić P, Dašić J, Crvenković B. Improving patient safety in hospitals through usage of cloud supported video surveillance. *Open Access Maced J Med Sci.* 2017 Mar 25;5(2):101-106. [PubMed] DOI: [10.3889/oamjms.2017.042](https://doi.org/10.3889/oamjms.2017.042)
  4. Wu R, Lo V, Morra D, Appel E, Arany T, Curiale B, et al. A smartphone-enabled communication system to improve hospital communication: usage and perceptions of medical trainees and nurses on general internal medicine wards. *J Hosp Med.* 2015 Feb;10(2):83-89. [PubMed] DOI: [10.1002/jhm.2278](https://doi.org/10.1002/jhm.2278)
  5. Stroud DB, Huang Y, Hansen L, McKenzie R. Walkie talkies cause more electromagnetic interference to medical equipment than mobile phones. *Australas Phys Eng Sci Med.* 2006 Dec;29(4):315-320. [PubMed] DOI: [10.1007/BF03178397](https://doi.org/10.1007/BF03178397)
  6. Malhotra N, Gupta N, Ish S, Ish P. COVID-19 in intensive care. Some necessary steps for health care workers. *Monaldi Arch Chest Dis.* 2020 Mar 25;90(1). [PubMed] DOI: [10.4081/monaldi.2020.1284](https://doi.org/10.4081/monaldi.2020.1284)
  7. Ford JH 2nd, Spears PT, Leemis RA, Woods CL. Centralized telemetry monitoring: implementation and management. *J Soc Health Syst.* 1991;3(2):52-68. [PubMed]
  8. Ramnath VR, Khazeni N. Centralized monitoring and virtual consultant models of tele-ICU care: a side-by-side review. *Telemed J E Health.* 2014 Oct;20(10):962-971. [PubMed] DOI: [10.1089/tmj.2014.0024](https://doi.org/10.1089/tmj.2014.0024)
  9. Jeremias A, Nguyen J, Levine J, Pollack S, Engellenner W, Thakore A, Lucre C. Prevalence of SARS-CoV-2 infection among health care workers in a tertiary community hospital. *JAMA Intern Med.* 2020 Aug 11:e204214. [PubMed] DOI: [10.1001/jamainternmed.2020.4214](https://doi.org/10.1001/jamainternmed.2020.4214)
  10. Nguyen LH, Drew DA, Graham MS, Joshi AD, Guo CG, Ma W, et al. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *Lancet Public Health.* 2020 Sep;5(9):e475-e483. [PubMed] DOI: [10.1016/S2468-2667\(20\)30164-X](https://doi.org/10.1016/S2468-2667(20)30164-X)