Challenges related to information handling during the COVID-19 pandemic: Experience of a secondary care hospital in Sri Lanka

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Abstract

Information management is among the top priorities during the COVID-19 pandemic, as it is a key element in decision-making. This brief report describes the following challenges faced in information handling during the COVID-19 pandemic and the outcome of solutions introduced as a response: telemedicine, disease notification, record keeping, real-time hospital dashboards, recording/reporting hierarchies and clinic drug distribution.

Many countries experienced challenges in providing resources and finances, developing communication networks and in information management at the outset of the COVID-19 pandemic [1,2]. Information management was among the top priorities as it was a key element in decision-making. Challenges faced by Sri Lankan hospitals were similar, and effective use of information technology was imperturbably accepted by health staff and the general public [3]. This brief report focused to describe the challenges faced in information handling during the COVID-19 pandemic and the solutions introduced in response.

Homagama Base Hospital is a secondary care hospital in Colombo district with a capacity of 407 beds. It has the second-highest catchment population of the country as a health institution. It comprises medical, surgical, obstetrics/gynecology, paediatrics, psychiatry, and ear, nose and throat specialties. The hospital serves around 85,000 inward Patients, 100,000 clinic patients and more than 300,000 outpatients annually [4]. Emergency care is available twenty-four hours over seven days of the week.

Hospital is equipped with a computerised hospital health information management system (HHIMS) developed by Information and Communication Technology Agency (ICTA). The Outpatient Department (OPD) functions completely through the computerised system since 2016, and in 2019 the family medical clinic which had the highest number of patient encounters started functioning through HHIMS. In the same year, the electronic laboratory information system was initiated which caters to the OPD. Data is saved in an institutional local server and a cloud backup is maintained. Software customization was done by ICTA while ground-level needs identification and implementation were coordinated by medical officers in health informatics guided by the hospital director.

With the onset of COVID-19 infection, the Director General of Health Services declared Homagama Base Hospital as a treatment centre for COVID-19 (suspected) patients with immediate effect. The hospital was given two days to discharge the admitted patients, terminate the routine services including OPD,

clinics and surgical procedures, and prepare to serve as a COVID-19 (suspected) patient treatment centre. Later when the number of confirmed cases began to rise in the country, the hospital was converted to a COVID-19 (diagnosed) patient treatment centre. In response to this, the hospital administration appointed a steering committee to facilitate hospital activities to meet the newly aroused challenges. The steering committee identified the possibility of using health informatics as a means of addressing the possible challenges in information handling at all levels among many other service needs.

A hospital information unit was established to identify and facilitate the conversion. A team of medical officers in health informatics from the Base Hospital Homagama, Western Provincial Directorate of Health Services and Ministry of Health voluntarily participated for need identification, coordination between hospital and software development agency, testing and implementation. Software customization was done by software engineers of ICTA and an agile method was adopted for development considering the uncertainty of requirement. The team identified the possibility of using health informatics solutions to address the challenges in communication barriers, record keeping and reporting, disease notification, provision of timely information for decision making at each level and coordination of clinic medicine distribution.

The key challenges addressed by the team were changes in information needs and problems in using the paper-based system. Information handling was critical for administrative decision making, managing logistics of the hospital, and disease control measures at the community level. Accuracy, completeness, and timeliness were very important in the context of a COVID-19 pandemic. Real-time information on bed occupancy was needed to accept patients from outside and allocate them to the wards ensuring optimal resource utilisation. Rapid patient turnover made the conventional paper-based logistic information pathways ineffective. Hospital operations such as meals allocation, supply of consumables to patients necessitated an efficient mode of information handling other than the conventional paper-based method. On the other hand, administrators were looking for strategies to manage a possible mass influx of patients. A flexible admission system that enables patient admission to the hospital at multiple admission counters / multiple wards was needed. Maintenance of conventional hospital admission registers and having accurate hospital statistics is impossible in such a setting with a paper-based admission system.

From a preventive care perspective, disease notification was critical for contact tracing and quarantine process than at any other time in history. Due to the lockdown state, the routine postal pathway was not available, and not speedy enough in a setting of a rapidly spreading disease.

In addition to the disease notification process, which was established decades ago, new information needs arose in the setting of COVID-19 infection. Multiple task forces were established at provincial and national levels and state and military intelligence units were also participating in the contact tracing process owing to the scale and gravity of the pandemic. All those stakeholders' activities greatly depend on the information received from hospitals, as the first place of encountering suspected patients.

Multiple units of the ministries of health and defence requested patient information to coordinate preventive activities, prepare national statistics and coordinate logistic operations. The same information has been requested by several stakeholders in different formats. No stakeholder has considered the data structure of the hospital registries when designing their data formats. The time frames and structure of each unit did not have any uniform order. Some units needed daily data from 6 am to 6 am while some units prefer midnight to midnight. Satisfying these demands using a conventional hospital admission record system can be cumbersome, especially in a pandemic situation with a large number of patients.

Solutions for identified challenges

It was decided to use telemedicine solutions to address communication barriers and to customize HHIMS to facilitate record keeping, reporting, disease notification, provide information for decision making at each level and clinic medicine distribution. The admission module of the current HHIMS was

customised and the Bed Head Ticket was generated as a printed document from the system. Admissions, discharges, transfers and deaths were recorded using the computer system at the point of action.

- **Telemedicine:** Telemedicine solutions were used at the patient screening area which is the first contact area of patients to hospital, admission counter and in the wards. At the initial stage, intercom phones were used for communication owing to low cost and ease in configuration but encountered technical issues owing to routine spraying of disinfectant solutions using spray machines to sterilise the buildings. Both health staff and patients were annoyed by the doctor-patient encounters where they can't see the other party they are speaking with. This negatively affected the quality of the doctor-patient relationship. To address this issue, the institution shifted to videoconferencing. The NUC (Next Unit of Computing) devices were used. Internet access was provided by LGN (Lanka Government Network) through Wi-Fi connectivity. The NUC devices were installed inside a protective casing of board and glass to allow the disinfection process without damaging the equipment. Skype videoconferencing application and meet.gov.lk videoconferencing platforms were used interchangeably. This improved the quality of the doctor-patient relationship significantly.

Ward rounds had to be minimized as much as possible to minimize the risk to the staff and to limit the use of personal protective equipment. As a strategic solution hospital employed a robot equipped with videoconferencing equipment. It was used to monitor the ward and to communicate with individual patients. Because of the movability of the robot, in contrast to fixed video conferencing solutions, staff were able to communicate with patients by their bedside using video conferencing. This was of use when there were bedridden or disabled patients.

Critical care beds and the intensive care unit were provided with continuous video surveillance and two-way audio communication equipment. Special attention was made to provide a clear view of the monitors attached to the patient. This minimized the number of times staff had to enter the patient area to monitor patients.

Telemedicine solutions were readily accepted by the staff and significantly improved their perception of safety from possible infection from patients. Most importantly use of telemedicine significantly reduced the use of personal protective equipment in all patient care areas.

- **Disease notification:** The hospital HHIMS consists of a notification module, which activates electronic disease notifications to every encounter due to a notifiable disease. The system also provides the facility to easily send the notification form in H544 format to a predefined email address. This electronic notification system was used intending a complete, accurate and timely notification process. All the patients were notified, and all the notifications reached the intended endpoints on the same day of patient encounter at the hospital. Furthermore, e-notifications prevented the exchange of documents within multiple units of the hospital and outside the hospital, which was advantageous as a preventive measure against COVID-19 spread.

- **Record keeping:** Hospital admissions were recorded using HHIMS by admission nurses. Patients were registered into the HHIMS with their demographic and contact details and a health identification number is issued for every patient. A registered patient can be admitted to the hospital through the Admission, Discharge and Transfer (ADT) module. Bed head ticket number was issued automatically by the system. Registration and admissions were done at a single admission counter initially, but it was planned to do admissions simultaneously at each ward if a massive patient flow is experienced. All the wards were provided access to the HHIMS through Ethernet and Wi-Fi connectivity. Ward admissions, inward transfers and discharges were entered into the HHIMS by ward staff.

Due to automated admission number allocation, the integrity of the admission number was maintained despite the presence of multiple admission points. This allowed maintaining a single hospital admission register while functioning multi-point admissions.

- **Real-time hospital dashboard:** A hospital dashboard was developed to provide real-time statistics graphically for administrative, logistic and reporting purposes. The dashboard consists of two main sections: the daily information section and the

cumulative information section. The daily information section provided information on the number of currently admitted patients, their gender-wise and age-wise distribution, patient distribution within wards, daily admissions, discharge, transfer and deaths summary. The cumulative section provided cumulative patient total, outcome summary of all the cases and trend of patient encounters during the past seven days in graphical format. The dashboard was displayed at the hospital director's office, meeting room, main admission counter and health information unit.

The availability of real-time information empowered decision-making at each level. Hospital administration was able to make decisions on accepting patients from other institutions, resource allocation, staffing based on real-time information and provide briefings to superiors and media. Hospital daily logistics including the provision of food, consumables to patients were managed smoothly despite the complex context created by the total lockdown of the country. Availability, timeliness and accuracy of information played a significant role in the overall smooth functioning of the hospital workflow.

- **Reporting/Reporting hierarchies:** COVID-19 pandemic made real-time reporting of aggregated and individual information important more than ever. The standard method of collecting morbidity data was through indoor morbidity and mortality return (IMMR) which was prepared by the medical record unit on a quarterly and annual basis. But COVID-19 pandemic created a context where all the levels of the reporting hierarchy depend on real-time information for decision making owing to the critical nature of taking immediate decisions at all levels. This was critical for both preventive actions and the optimal functioning of logistic operations and resource allocation. New channels of reporting were needed to satisfy this need.

Aggregated admission, transfer and discharge information was needed by regional and provincial directorates of health, epidemiology unit, medical services unit, state intelligence services and military intelligence unit and provincial Covid taskforce. Whereas intelligence services and the epidemiology unit needed detailed individual patient information for contact tracing and coordinating screening and quarantine measures. Due to the criticality of timeliness of reporting, email was preferred as the mode of communication. The hospital admission register was customised to meet the information need of the above stakeholders and made available as a downloadable PDF document which was emailed routinely to each stakeholder. The report can be generated for a selected duration of days and generated from 12:00 hour to 12:00 hour of selected days which was the standard practice in hospital settings.

- **Clinic drug distribution:** The hospital's routine functions including clinics were completely stopped. Patients of the hospital had no means of getting their clinic drugs. To address this issue, a call centre was established for clinic patients. All the patients who request clinic medicine were entered into the relevant clinic using HHIMS. A list of patients who requested medicine was given to the relevant clinic staff daily to coordinate dispatching of medicine, and administration for monitoring the process. This made cross-checking and responding to patients' inquiries about the state of their order more convenient, which is impossible in a paper-based system.

The hospital had 21 clinics, out of which family medical clinic (FMC) has the highest number of annual patient encounters and had 95,000 patient visits in 2019. The clinic operates through HHIMS, whereas all other clinics are still paper-based. Medicine dispatching in this clinic was observed to be significantly easier, faster and accurate.

Conclusion

The paper-based health information handling pathways were prone to be inefficient and ineffective in the context of a rapidly spreading pandemic. Rapid patient turnover and health service saturation, social lockdown and services and, communication disruptions due to distancing measures were unprecedented. Rapidly developing new information needs and the need for real-time information are the main reasons for this gap.

Telemedicine and health informatics solutions are important to address communication barriers and to facilitate record keeping, reporting, disease notification in a pandemic situation.

Author declaration

Author contributions: All authors contributed to the conceptualization and design of the study. MBRMCLJ, NDK, AKJMW, NMD, WDRP, SKPAF and AW contributed to the acquisition of data. UNP and ALAUL conducted the data analysis. JH, MBRMCLJ, AKJMW and SKPAF contributed to data interpretation and writing the manuscript. All authors read and approved the final manuscript.

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