

Intelligent Graduate Medical Education Dashboard (IGMED) to Enhance Trainee Oversight During the COVID-19 Pandemic

Kellie L. Kiernan¹, Maha Al Fahim¹, Thana Harhara², Satish Chandrasekhar Nair³, Halah Ibrahim²

¹Education Institute, Sheikh Khalifa Medical City, Abu Dhabi, United Arab Emirates

²Department of Family Medicine, Sheikh Khalifa Medical City, Abu Dhabi, United Arab Emirates

³Tawam Hospital, Department of Academic Affairs, College of Medicine, United Arab Emirates University, Al Ain, United Arab Emirates

Corresponding author: Satish Chandrasekhar Nair, Tawam Hospital, Department of Academic Affairs, Post Box 15258, College of Medicine, United Arab Emirates University, Al Ain, United Arab Emirates. E-mail: satchi2000@outlook.com+97137074739. ORCID ID: <https://orcid.org/0000-0003-2095-1893>.

doi: 10.5455/aim.2021.29.10-14

ACTA INFORM MED. 2021 MAR 29(1): 10-14

Received: Jan 25, 2021

Accepted: Mar 18, 2021

© 2021 Kellie L. Kiernan, Maha Al Fahim, Thana Harhara, Satish Chandrasekhar Nair, Halah Ibrahim

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Medical residents comprise a large, but unique, subset of the physician workforce. They serve as front-line staff, but are trainees, regulated by duty hour and supervision restrictions. Heightened oversight is necessary to ensure resident supervision and safety whilst mobilizing this important workforce during crisis. This manuscript describes the development and implementation of an institutional crisis dashboard to facilitate timely information gathering and decision-making regarding resident activities during the COVID-19 pandemic. **Objective:** The purpose of the study was to develop an intelligent graduate medical education dashboard to centralize and integrate data to support accurate, timely decisions in several areas: (1) track redeployment; (2) ensure adherence to supervision and duty hour regulations; and (3) monitor infection control and safety measures. **Methods:** The dashboard is a live Microsoft Excel database saved to a shared fileserver. All existing databases within the education department were reviewed to form a foundational template. A monitoring section provides at-a-glance information on trainee assignments. Embedded color-coded flags attached to specific responses immediately highlight areas of deficiency. **Results:** The dashboard facilitated the efficient mobilization of trainees, while ensuring assignments followed education regulations. It allowed the education office to centralize and proactively arrange mass scrubs orders, facemask fitting, and personal protective equipment training. It was a monitoring system that enabled recognition of safety concerns in real-time, including identifying areas where residents were most exposed or infected. **Conclusion:** The dashboard improved the efficiency of crisis response, while prioritizing resident safety. It is feasible, low cost and easily accessible, even during Internet disruption. It can be used by hospitals worldwide, including low resource settings.

Keywords: Dashboard, Crisis management, residents, Gulf, disaster planning.

1. BACKGROUND

Weather emergencies, mass casualty incidents and infectious disease outbreaks, all necessitate rapid coordination and mobilization of the hospital workforce and rapid orientation of the healthcare system. Pandemics create unique challenges in that they require prolonged mobilization of healthcare professionals, who are, themselves, at particular risk for exposure (1). Medical residents comprise a large, but unique, subset of the physician workforce. They can be valuable assets during disaster events as they can be rapidly mobilized and deployed to other roles and locations with minimal ad-

ditional training (2). Although they are routinely front-line staff, they are trainees, regulated by educational guidelines, duty hour restrictions, and must work under supervision (3). Further, their inexperience and lower power status in the medical hierarchy make them especially vulnerable to medical and safety errors, which can have serious consequences for themselves and their patients, especially during an infectious disease outbreak (4). For example, an audit of needlestick injuries in an academic hospital surgical department showed that 40% occurred among surgical staff and medical trainees (4). Other

studies have shown that resident perceptions of the risk of contracting a contagious disease, along with the fear and anxiety tied to exposures, are often higher than expected (5). For trainees, there must be a balance between the risk of harm and the duty to provide care. It is, therefore, incumbent upon graduate medical education departments to heighten oversight to ensure resident supervision and safety whilst mobilizing this important workforce during times of crisis. The Coronavirus, SAR-CoV-2, now known as COVID-19, a novel and highly communicable pathogen, erupted from Wuhan, China in December 2019. Shortly after, the World Health Organization (WHO) declared a public health emergency of international concern for COVID-19 (1). The COVID-19 pandemic has challenged training programs worldwide to educate and support trainees who are expected to participate in disaster responses, while providing proper training, supervision and safety protocols.

Sheikh Khalifa Medical City is the largest government hospital in Abu Dhabi, United Arab Emirates. It is also the largest provider of postgraduate medical education in the United Arab Emirates, currently sponsoring 268 trainees across internship, 8 residency programs, and 4 fellowships. All trainees and education activities are managed under a centralized Graduate Medical Education office overseen by the Designated Institutional Official. Early in the pandemic, between April and August 2020, the institution became a designated COVID-19 hospital and referral center for higher acuity cases. Hospital leadership quickly recognized that the trainees were the largest body of doctors readily available for lateral redeployment across the hospital system, and the Graduate Medical Education office began receiving requests to launch screening, tracing, and telemedicine initiatives, and provide clinical staffing to expanded patient spaces. Most of this data was already collected, but was maintained in various formats, often siloed within individual programs, and required extensive cross-referencing and verification, resulting in lengthy delays. Information gathering was further complicated as administrative staff and program coordinators were working from home to minimize infection risk.

Dashboards have been widely used in medical education to track learner milestones, monitor continuous quality improvement, and help programs meet institutional goals and accreditation requirements (2, 6). In recent years, health care systems have utilized disaster preparedness dashboards (2, 7). Dennis and colleagues, for example, described a categorization schema to facilitate horizontal deployment of trainees in emergency situations (2). Other disaster dashboards have been described, and primarily focus on ensuring adequate physician staffing to maintain hospital operations and patient

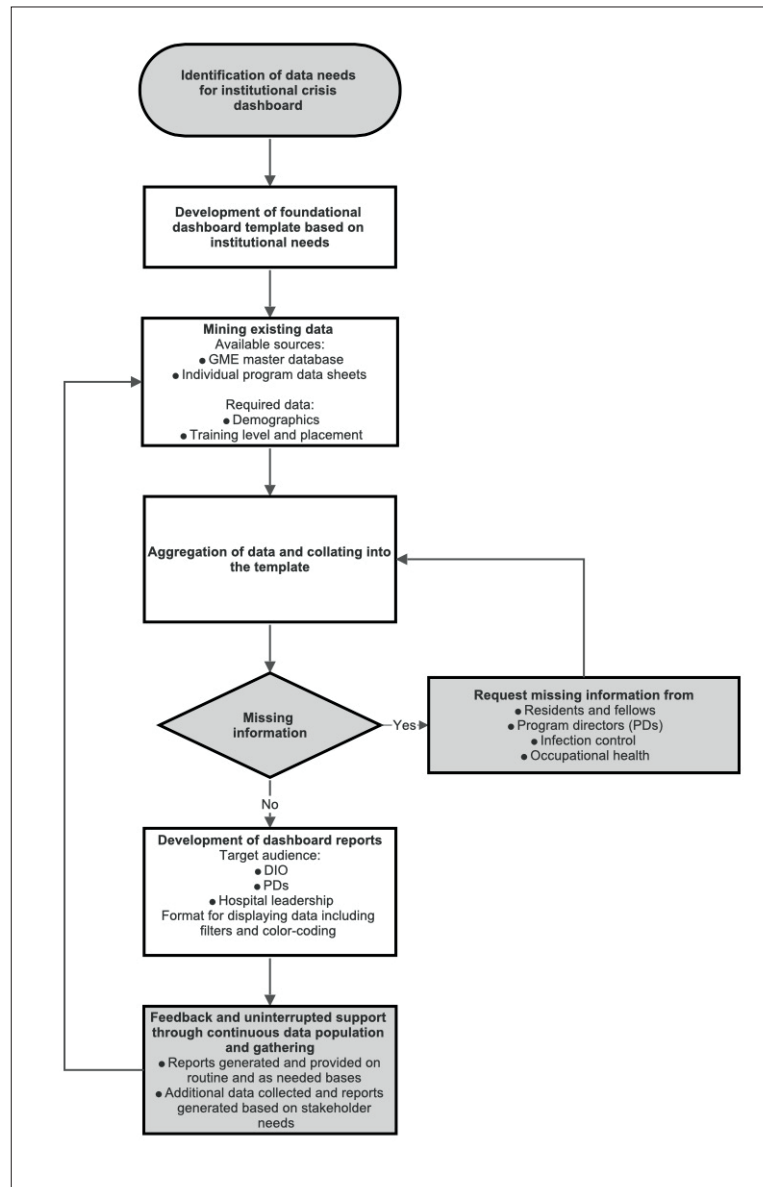


Figure 1. Flowchart of dashboard (Intelligent Graduate Medical Education dashboard (IGMED) development

safety (8-10). Web-based residency management systems, such as New Innovations and Med Hub, also exist for scheduling (9). Similarly, we aimed to track off-specialty assignments, but our main priority was resident supervision and safety.

The need for an intelligent, accurate and unified system to better facilitate increasing staffing requests and mobilize trainees more efficiently was imperative. The challenge was to develop a feasible, quickly deployable and low-cost version that would be accessible even during Internet disruption, and could be implemented in low resource settings.

2. OBJECTIVE

The present study is aimed at developing an institutional intelligent graduate medical education dashboard for effective crisis management, with the goal to centralize and integrate data to support accurate, timely and efficient decisions in several key areas: a) track redeploy-

Safety/Risk Indicator	Rationale
Current Assignment	To determine if trainee is available for redeployment, or already working on a supervised COVID unit, and to provide a record of residents assigned outside of the spectrum of normal specialty requirements.
Duty Hour Violations	To ensure trainees continue to be meet duty hour requirements.
Quarantine Status	To monitor trainees that have been exposed to COVID positive cases, track return to service dates, and ensure occupational health clearance has been received prior to resumption of duty.
Screening	To monitor that hospital mandated healthcare worker screening has been scheduled, completed and track trainee infection rates
COVID Care Exemptions	To note trainees exempt from direct COVID patient care due to pregnancy, immunosuppression or other eligible pre-existing conditions, as determined by Occupational Health Services.
Scrubs	To ensure all trainees, regardless of specialty, are assigned hospital-issued scrubs eligible for hospital laundry.
N95 Fitting / POWERED AIR-PURIFYING RESPIRATOR	To ensure all trainees are properly fitted for N95 face masks, maintain a record of all face mask models/sizes applicable to the trainees and ensure POWERED AIR-PURIFYING RESPIRATOR training for all trainees who fail N95 mask fittings
PERSONAL PROTECTIVE EQUIPMENT Training	To ensure all trainees receive appropriate PERSONAL PROTECTIVE EQUIPMENT training prior to high-risk assignments
Risk Accommodation	To maintain a record of all trainees currently living with families/roommates to anticipate risk accommodation needs and to monitor risk accommodation requests and placements.

Table 1A. Key trainee parameters and rationale for inclusion in the Intelligent Graduate Medical Education dashboard (IGMED)

ment of residents with new assignments relevant to their level of training; b) ensure adherence to supervision and duty hour regulations; and c) monitor trainee infection control and safety measures.

3. METHODS

All existing databases within the education department of the institution were reviewed to form a foundational template.

Inclusion and exclusion criteria for displayed data were initially driven by details most requested from hospital leadership, but soon included information necessary to maximize trainee safety. The following components imperative for dashboard (Intelligent Graduate Medical Education Dashboard) development were identified and information collected from the institutions databases:

Personal Data: The Graduate Medical Education office already maintained an active master database of all trainees, comprised primarily of personal demographic information, including specialty, year of training, date of hire, medical license number, and contact information. It is a live Microsoft Excel database saved to a shared file-server and is maintained by the program coordinators.

Trainee Monitoring

To build the functional section of the dashboard, existing studies and published models of dashboard development were reviewed (6, 9).

A primary function of the monitoring section was to provide at-a-glance information on each trainee’s current assignment. This was necessary to ensure that residents were allocated to areas with adequate supervision relevant to their level of training. Tracking was also important to periodically rotate residents off of critical care units, in an effort to avoid potential emotional distress and burnout from prolonged management of the severely ill subset of COVID-19 patients. Dashboard development is shown in Figure 1.

4. RESULTS

The Personal Data Microsoft Excel Database provided a foundation of accurate data on all trainees and became

the first component of the final dashboard. All personal details were comprehensively stored in the database, but to provide a concise visual display, general data columns that were not in regular demand (such as medical license numbers), could be hidden and unhidden as needed within the functions of the excel document.

Safety Indicator	Descriptors / Flags	Tracking Frequency
Current Assignment	Rotation (program requirement)	Weekly / Monthly
	Leave type / return date	
	Assignment (non-program requirement)	
Duty Hour Violations	Quarantine	Monthly
	None	
Quarantine Status	Violation Category	Daily / weekly Follow Up as needed
	None	
	Pending OHS Clearance	
HCW Screening	Returned to duty (clearance received)	Daily / weekly
	(-) Negative Result	
	Results Pending	
	No Screen	
COVID Care Exemptions	COVID +	Monthly
	None	
Scrubs	Exemption Type	Daily / weekly
	No	
	SKMC Scrubs	
N95 Fitting / POWERED AIR-PURIFYING RESPIRATOR	Personal Scrubs	Daily / Weekly
	Mask Size / Model	
	Pending Fitting	
	Failed / Pending POWERED AIR-PURIFYING RESPIRATOR	
PERSONAL PROTECTIVE EQUIPMENT Training	POWERED AIR-PURIFYING RESPIRATOR Training	Daily / Weekly
	Yes	
Risk Accommodation	No	Follow Up as needed
	Family / Roommate	
	Alone / Risk Accommodation	
	Risk Request Pending	

Table 1B. Key safety parameters monitored by the Intelligent Graduate Medical Education dashboard (IGMED) with descriptors and tracking frequency

Table 1A lists the information available in this section, and the rationale underpinning its inclusion. The indicators correlated to the most common issues from daily meetings and correspondence, as the hospital adjusted services to meet pandemic demands. Safety indicators provided potential risk information to the Designated Institutional Official and program directors- critical to decision making as surge planning was implemented. Further, data filters were operational on each column, and unified language drop-down options were programmed into the document to optimize filtering when responding to specific data-requests (Table 1B). Embedded color-coded flags attached to specific responses immediately highlighted areas of deficiency. This enabled the Graduate Medical Education office to quickly identify issues that required follow-up or that should be factored into redeployment decision-making. The initial training time on dashboard functions for the coordinators was approximately 3 hours. Program coordinators were responsible for dashboard maintenance, ensuring that data was current, and following up on all actionable items until they were resolved. Ongoing coaching and support was provided to all coordinators to ensure that issues were followed through to resolution (6). The institutional coordinator monitored daily updates from each program. Due to data privacy and sensitivity, the Intelligent Graduate Medical Education dashboard (IGMED) is not made available on a broader platform for hospital leadership but instead remains on a shared hospital files server with access limited to coordinators, program directors and the designated institutional official. Temporary, secure remote access to this files server was granted to coordinators while they were working from home during this crisis.

5. DISCUSSION

The Intelligent Graduate Medical Education dashboard (IGMED) was quickly conceptualized, designed and launched following a 5-day period of populating information fields and making adjustments based on user input. The dashboard was able to centralize and integrate data to support accurate, timely and efficient decision-making. Prior to Intelligent Graduate Medical Education dashboard (IGMED) development, responses to information requests to the Graduate Medical Education office would take several hours to perform data searches and to send and receive emails and phone calls to gather details from individual residents, program coordinators, and program directors. With centralized and instantly retrievable data, the Intelligent Graduate Medical Education dashboard (IGMED) enabled immediate response to incoming requests for assistance and information. Further the dashboard enabled trainee redeployment relevant to their level of training by tracking of resident rotations and supervision. It also allowed reallocation of residents unable to participate in direct clinical care due to underlying medical conditions to telehealth and contact tracing services. The Intelligent Graduate Medical Education dashboard (IGMED) was able to ensure adherence to supervision and duty hour regulations. Supervision provisions were confirmed by the Graduate Medical Educa-

tion office as part of the approval process for redeployment. Any changes in supervision in areas of resident allocation also needed to be routed through the Graduate Medical Education office. Duty hour violations were recorded and flagged weekly to allow the Graduate Medical Education office to address them in real-time. Safety concerns were addressed through close monitoring of trainee infection control and safety measures. The data filtering options in the Intelligent Graduate Medical Education dashboard (IGMED) allowed the education office to take a proactive approach in arranging mass scrubs orders, face mask (N95) fitting, powered air-purifying respirator and personal protective equipment training. Prior to the launch of the dashboard, these gaps were addressed by individual programs in the Graduate Medical Education Office and in an ad hoc manner. N95, powdered air-purifying respirator, and personal protective equipment training became streamlined, and the infection control team was organized to deliver these needs to small multi-specialty groups, rather than individuals, thereby maximizing time and resource utilization. A notable example of the Intelligent Graduate Medical Education dashboard (IGMED) efficacy was when certain N95 mask sizes or models were in short supply, the Graduate Medical Education dashboard office was alerted and quickly determined which residents were affected to redeploy them to lower risk areas as needed to maintain trainee health and safety. We were also able to triangulate areas where residents were most exposed or infected. Through the Intelligent Graduate Medical Education dashboard (IGMED), we identified areas in the emergency department and screening clinics where several of our residents were infected and addressed these concerns with infection control and hospital administration. We reinforced Personal Protective Equipment education and assigned more senior resident and faculty supervision to these areas and were successful in preventing further infection. As such, the dashboard served as a monitoring system that allowed recognition and reporting of concerns in real-time.

The Intelligent Graduate Medical Education dashboard (IGMED) is a low-cost, easy to replicate intervention that enabled us to improve the efficiency of the Graduate Medical Education office's crisis response while prioritizing the safety of the trainees in all decision-making processes. It provided the institution with a method of demonstrating that supervision and duty hour requirements were met, even during a crisis period. The dashboard is relevant to the current needs of the hospital and Graduate Medical Education office and can be easily adapted as the situation evolves. It is quickly accessible, actionable, and monitorable (6). It was widely employed to rotate resident duties in an effort to avoid burnout and to pro-actively address safety concerns during each phase of surge planning, ensuring cohesion between hospital needs and the broader priorities of the education office.

The biggest challenge faced during the process was initial data collection and entry. Some programs had incomplete resident files, and multiple phone calls and emails were necessary to obtain missing information from

trainees, who were working hard in the midst of a pandemic. The major limitation of the Intelligent Graduate Medical Education dashboard (IGMED) development was the lack of multiple stakeholder input, particularly the lack of the residents' voices in key parameter selection. This was not possible during a pandemic, but as the cases subsided, resident input was obtained and implemented. The Intelligent Graduate Medical Education dashboard (IGMED) design has recently been shared with other training hospitals in the region.

6. CONCLUSION

Healthcare systems globally will continue to deal with infectious disease outbreaks and other disaster events, and need to balance trainee safety with patient care. The implementation of an intelligent graduate medical education dashboard was a vital part of our hospital's emergency response. It is cost-effective, easy to implement and can be used by hospitals worldwide, even in low-resource settings. The design and development of the Intelligent Graduate Medical Education dashboard (IGMED) will be useful in international settings with similar challenges during a crisis.

- **Authors' contributions:** All authors conceived the study; KLK, MA collected the data; KLK and TH prepared the figures and tables; KLK, HI drafted the manuscript; MA, SCN, TH revised the manuscript; All authors read and approved the final draft.
- **Conflict of interest:** None declared.
- **Financial support and sponsorship:** No funding was obtained for this study.

REFERENCES

1. Wu YC, Chen CS, Chan YJ. The outbreak of COVID-19: An overview. *J Chin Med Assoc.* 2020; 83(3): 217-220.
2. Dennis B, Highet A, Kendrick D, et al. Knowing your team: rapid assessment of residents and fellows for effective horizontal care delivery in emergency events. *J Grad Med Educ.* 2020; 12(3): 272-279.
3. Accreditation Council for Graduate Medical Education. <https://acGraduateMedicalEducation.org/Newsroom/Newsroom-Details/ArticleID/10188/-Reaffirms-its-Four-Ongoing-Requirement-Priorities-during-COVID-19-Pandemic>. accessed 22 September 2020.
4. Hasak JM, Novak CB, Patterson JMM, Mackinnon SE. Prevalence of needlestick injuries, attitude changes, and prevention practices over 12 years in an urban academic hospital surgery department. *Ann Surg.* 2018; 267(2): 291-296.
5. Rambaldini G, Wilson K, Rath D, et al. The impact of severe acute respiratory syndrome on medical house staff: a qualitative study. *J Gen Intern Med.* 2005; 20(5): 381-385.
6. Epstein J, Noronha C, Berkenblit G. Smarter screen time: integrating clinical dashboards into graduate medical education. *J Grad Med Educ.* 2020; 12(1): 19-24.
7. Shroyer A, Lu W, Chandran L. Drivers of dashboard development (3-D). *Acad Med.* 2016; 91(4): 517-521.
8. Stevens JS, Toma K, Tanzi-Pfeifer S, et al. Dashboards to Facilitate Nephrology Disaster Planning in the COVID-19 Era. *Kidney Int Rep.* 2020; 3; 5(8): 1298-1302.
9. Hollenbach SJ, Harrington A, Duecy E. Automated Residency Scheduling: Impacts on Resident Satisfaction and Wellness. *Obstet Gynecol.* 2018; 131: 31S.
10. Boscardin C, Fergus K, Hellevig B, Hauer K. Twelve tips to promote successful development of a learner performance dashboard within a medical education program. *Med Teach.* 2018; 40(8): 855-861.