Simulathon 2020

Integrating Simulation Period Prevalence Methodology Into the COVID-19 Disaster Management Cycle in India

Sujatha Thyagarajan, DCH (UK), FRCPCH (UK), CCT in Paediatrics (UK);

Geethanjali Ramachandra, MRCP, CCT PICU(UK);

Vijayanand Jamalpuri, MD, FRCPCH (UK), CCT in Paediatrics (UK);

Aaron W. Calhoun, MD, FSSH;

Vinay Nadkarni, MD, MS;

Ellen S. Deutsch, MD, MS, FACS, FAAP, FSSH, CPPS;

for the Pediatric Simulation Training and Research Society (PediSTARS)

Summary Statement: The disaster management cycle is an accepted model that encompasses preparation for and recovery from large-scale disasters. Over the past decade, India's Pediatric Simulation Training and Research Society has developed a national-scale simulation delivery platform, termed the *Simulathon*, with a period prevalence methodology that integrates with core aspects of this model. As an exemplar of the effectiveness of this approach, we describe the development, implementation, and outcomes of the 2020 Simulathon, conducted from April 20 to May 20 in response to the nascent COVID-19 pandemic disaster. We conclude by discussing how aspects of the COVID-19 Simulathon enabled us to address key aspects of the disaster management cycle, as well as challenges that we encountered. We present a roadmap by which other simulation programs in low- and middle-income countries could enact a similar process.
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Key Words: Simulathon, disaster management cycle, period prevalence.

The World Health Organization declared the outbreak of novel coronavirus 2019 as a public health emergency of international concern on January 30, 2020.[1] By April 20, 2020, more than 2.6 million individuals had tested positive with a reported death toll of 177,143 people worldwide.[2] In India, 18,457 individuals had tested positive with 573 deaths,[3] generating great concern for catastrophic nationwide spread. Webinars and published reports shared lessons from local hotspots among healthcare professionals globally to help understand and manage COVID-19.[4,5] These multiple reports contained new approaches to identify possible COVID-19 patients, protect healthcare workers (HCWs) using personal protective equipment (PPE) and manage the physiologic consequences of infection. In addition, different management strategies for aerosol generating procedures (eg, tracheal intubation), nebulization, noninvasive ventilation, and cardiopulmonary resuscitation were recommended.[6–15] There was an urgent need to rapidly determine the preparedness of individual centers to enact these recommendations and to disseminate needed education.

The disaster management cycle is an accepted model for conceptualizing preparedness for any type of severe regional, national, or international event.[16–20] This model posits a 3-phase approach beginning with a predisaster phase, the disaster itself, and, finally, the postdisaster recovery period. Each phase is linked with key methodologies and actions that are needed for an adequate response.

Over the past several years, the Pediatric Simulation Training and Research Society (PediSTARS) has advocated for and provided simulation-based training to 5800 doctors, 750 nurses, and 380 facilitators. During this time, the PediSTARS developed and pilot tested a process termed the *Simulathon* that involves the coordinated implementation of simulation activities concurrently at multiple sites throughout India, collecting data using the "period prevalence" epidemiologic approach.[21,22] The term is intended to evoke a "marathon"-like event over a predefined period that raises awareness of simulation and simultaneously accomplishes a task for public good (similar to the concept of running marathons for charity). Previous Simulathons have focused on pediatric trauma, hemorrhagic shock, cardiopulmonary resuscitation (CPR), septic shock, and communication (Table 1).

Given the need to address the potential disaster brought by the COVID-19 pandemic, the PediSTARS leveraged the

From the Aster RV Hospital (S.T.), Bangalore; PediSTARS (S.T.); Department of Pediatric Intensive Care (G.R.), Krishna Institute of Medical Science, Secunderabad; Pediatric Simulation Training and Research Society (G.R.); Rainbow Children's Hospital (V.J.), Hyderabad, India; Department of Pediatrics (A.W.C.), Norton Children's Hospital, University of Louisville, Louisville, KC; and Departments of Anesthesiology (V.N., E.S.D.), Critical Care (V.N.), and Pediatrics (V.N.), Children's Hospital of Philadelphia, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA.

Correspondence to: Sujatha Thyagarajan, DCH(UK), FRCPCH(UK), CCT (Paediatrics), Aster RV Hospital, CA-37, 24th Main Rd, ITI Layout, 1st Phase, J. P. Nagar, Bengaluru, Karnataka 560078, India (e-mail: sujadoc@gmail.com).

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TABLE 1. PediSTARS In Situ Simulathon Projects

Topic/Theme	Implementation Goals	Timing	Participants	Period Prevalence Data
1. **1st National Trauma Simulathon:** Primary and secondary surveys in pediatric trauma	Assess current knowledge regarding conduct of basic primary and secondary surveys in children, and provision of team training to improve these skills	October 2016 World Trauma Day	20 centers from India including ED nurses and doctors, pediatricians, undergraduate and postgraduate students, and parents	All centers uniformly identified gaps in knowledge of initial assessment and primary survey of pediatric trauma, as well as skills such as needle thoracocentesis and team leadership. All centers uniformly reported 100% acceptance of simulation-based training and the need to have more such training sessions locally to enhance their learning experience. The challenges described by the simulation trainers include time and equipment constraints for regular simulation training locally.
2. **2nd National Trauma Simulathon:** Controlling major hemorrhage in pediatric trauma	Assess the ability of participating centers to effectively activate hemorrhage protocol in the ED and provision of team training to improve these skills.	October 2017 World Trauma Day	14 centers from India	All centers were able to test their major hemorrhage protocol, identify gaps such as delays in asking for O-negative blood, and after the request, delays in receiving O-negative blood in the ED, as well as determining the correct ratio of blood products to be infused.
3. **SSH Healthcare Simulation Week:** Managing septic shock using in situ simulation	Disseminate in situ simulation scenarios designed to improve the management of pediatric septic shock at the participating sites.	September 2018	Total 57 centers: 53 centers from India 4 centers from other countries	All centers reported that it was useful. Centers identified an average of 5 gaps (minimum = 3, maximum = 11). System changes were made in 54 centers addressing early administration of antibiotics, SBAR handovers, push-pull rapid infusion technique, code blue [emergency] system, PEWS score implementation, and transport checklists.
4. **ResusSimulathon:** Resuscitation for cardiac arrest–asystole/VF	Disseminate in situ simulation scenarios designed to determine time to defibrillation	June 2019	25 centers from India	Introduced the CPR coach concept with reported improvement of time to defibrillate from 4.5 to <2 min via RCDP.
5. **SSH Healthcare Simulation Week:** Enhancing communication skills	Disseminate scenarios designed to assist in the implementation of the SPIKES[23] protocol for effective clinician/patient communication.	September 2019	Total 48 centers: 45 centers from India 3 centers from other countries	All the centers identified areas for improvement while communicating with parents (eg, avoid medical jargon). 64% of participating centres made system changes by implementing "SPIKES" protocol. Participating centers also identified areas needing further communication training (eg, handovers among health care professionals)

PEWS, Pediatric Early Warning Score; SSH, Society of Simulation in Healthcare; RCDP, Rapid Cycle Deliberate Practice; SBAR, Situation, Background, Assessment, Recommendation; SPIKES, Setting, Perception, Invitation, Knowledge, Empathy, Summary; VF, ventricular fibrillation.

Simulathon concept to address key aspects of the disaster management cycle in an effort to deliberately engage with and contribute to the overall disaster preparedness level in India. In this *Concepts and Commentary*, we discuss the conceptual linkages between this cycle and the Simulathon period prevalence process, report on the outcomes, and provide a guide to implement a similar process in their own state or country.

CONCEPTUAL UNDERPINNINGS

The disaster management cycle consists of 3 phases,[16–20] each temporally keyed to the disaster itself (ie, before, during, and after). Each phase includes 1 or more critical actions that must be successfully navigated to mitigate the event. The most important element of the predisaster phase includes the assessment of preparedness and development of proactive mitigation strategies. Once the disaster arrives, the focus shifts to data gathering regarding its ongoing impact and the implementation of previously developed plans. After the disaster concludes, the focus shifts to collecting and analyzing data regarding rehabilitation, recovery, and response and disseminating any findings to improve processes further. In addition to these phase-specific aspects of the model, several activities have been highlighted that add value throughout the cycle, including rapid needs assessments, ongoing surveillance, and the use of data tracking systems, such as registries, to gauge the ongoing health impact of the disaster (Fig. 1).

In situ simulation-based training represents a powerful means to prepare healthcare teams to practice disease specific protocols, identify system latent safety issues, measure the impact on patient safety, and refine patient care processes on a local and regional level.[24–27] Simulation-based education has successfully been applied to prepare individual hospital systems and HCWs in the context of the Ebola epidemic, and various programs across the world have subsequently applied simulation-based training to prepare their individual healthcare teams and hospitals to receive COVID-19 patients.[28–36] Successful dissemination of standardized in situ training scenarios has also been described over large areas of the developed countries.[37–40] This growing body of work highlights the value that simulation-based activities can add to assessment of and preparedness for disasters.

The Simulathon structure, evolving over the past several years, allows the wide dissemination of assessments and lessons learned on an even larger scale. By deploying concurrent, multiple simulations across multiple representative sites, the assessment and education capabilities of in situ simulation can be applied effectively at a national level. Given this scope, the Simulathon process can generate robust needs assessment data in short time frames, quantify center-specific solutions and gaps in preparedness, and disseminate this information such that other participating sites benefit immediately. This approach is much like the epidemiologic "period prevalence" approach used to generate needs analyses and interventions.[21,22]

Finally, by providing a centralized platform within which site-specific disaster-related latent safety threats can be collected, analyzed, and synthesized, the Simulathon process can catalyze the creation of national-level preparedness and mitigation plans.

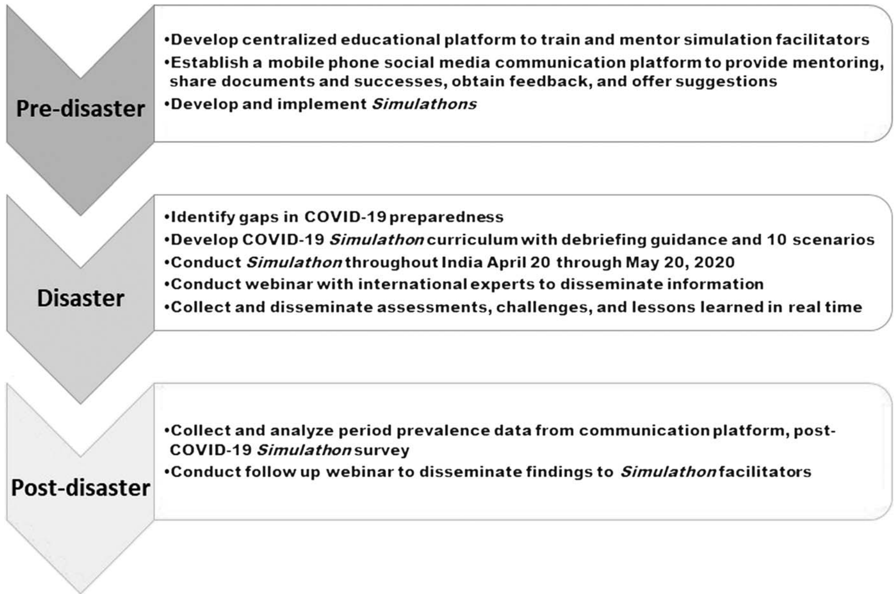

FIGURE 1. Period prevalence methodology in the COVID-19 disaster management cycle.

As an illustration of this, we next describe the development and implementation of the April 2020 PediSTARS Simulathon, which focused on the incipient COVID-19 pandemic.

DEVELOPMENT

As the date of the Simulathon approaches, India did not yet have many COVID-19 cases, and we had relatively limited personal experience on the application of simulation-based training to prepare hospitals for pandemics. Nevertheless, we recognized the opportunity afforded by this technique based on evidence emerging about new resuscitation rules and isolation policies.[41–44]

A core team of PediSTARS leaders designed a standardized simulation-based curriculum for COVID-19 preparedness. Over the course of a week, 10 scenarios were created based on evolving available evidence that focused on skills, such as donning and doffing PPE, clinical patient management processes, and protocols for settings, such as emergency department (ED), pediatric intensive care unit (PICU), neonatal intensive care unit (NICU), and operating theaters. These scenarios are shared as Supplemental Digital Content (see document, Supplementary Digital Content 2, Simulathon scenarios http://links.lww.com/SIH/A718). Scenarios were shared with PediSTARS-trained Simulathon facilitators to minimize redundant effort, while allowing local modification. Supporting guidelines addressing management of COVID-19, donning and doffing PPE, tracheal intubation for respiratory failure, and new CPR policies from the American Heart Association were also shared and reviewed with the trainers to refine local policies and processes. Finally, PediSTARS-trained facilitators were instructed to use Plus/Delta and PEARLS (Promoting Excellence and Reflecting Learning in Simulation) methodology–based debriefing techniques.[45] The timing was suitable for conducting such simulation sessions as Indian healthcare facilities had smaller caseloads amid the nationwide lockdown before the pandemic peak. The Simulathon period prevalence program was conducted over a 30-day period between April 20 and May 20, 2020.

IMPLEMENTATION STRATEGIES

The PediSTARS has used various complementary strategies to maintain high levels of engagement in the Simulathons. A WhatsApp[46] (Facebook, Menlo Park, CA) group was formed at the society's inception containing the contact numbers of simulation educators trained via the PediSTARS. This has been updated over the intervening years as a living document and is frequently used by former trainees to share updates on local and regional work (including photos, challenges, solutions, and lessons learned). This provides us with a readily accessible platform for connecting with former trainees, encouraging participation by member sites, and sharing encouraging words and photos.

WhatsApp is a popular free social media platform in India. It provides the option of creating groups with restricted, personalized membership, allowing the easy creation of discussion groups with similar interests. This feature not only enables directed dissemination of content to those with the most potential interest but also allows the creation of psychologically safe environments for conversation. If content is felt to be appropriate for a larger audience, it can then be shared more widely at the discretion of individual group members. These features have enabled the PediSTARS to create a communication structure that supports effective engagement.

As a Simulathon approaches, the WhatsApp means of contact is supplemented by personal phone calls by core PediSTARS team members to key educators at local sites. The sign-up of key educators encouraged and influenced many others to sign up as the event approached.

Each Simulathon is also designed to focus on specific themes known to be engaging to member centers. By focusing these themes on problems of mutual interest across centers, we were able to enhance interest and build long-term engagement in the Simulathon process. Throughout this, the PediSTARS has worked to maintain an inclusive ethos as well as ongoing commitments from international experts. When combined with the relevance of the chosen themes, this has resulted in an overall level of positive engagement with our work across India. All the simulation activities locally are viewed as a celebration and shared via social media alongside lessons learned. Finally, a report is created once each Simulathon is complete that highlights the impact of the event in a way that supports its ongoing relevance to the national and international simulation community.

SIMULATHON SITE DATA COLLECTION, COLLATION, AND ANALYSIS

Data from the Simulathon were collected using 2 methods: real-time communication and debriefing and a post-Simulathon survey. A follow-up webinar was conducted to share the data collected.

Because there were no patient data or sharing of confidential patient information involved in the analysis, the report met criteria for exemption by the local institutional ethics committee at the Rainbow Children's Hospital, Bangalore.

Real-Time Data Collection

Real-time information gathered during the Simulathon was collected and distributed via the WhatsApp group. Members shared simulation photographs, lessons learned from local team debriefings, and challenges identified during the simulation. Regular debriefings sharing experiences among facilitators, selected for impact or controversy by senior PediSTARS members, were also conducted using WhatsApp. These discussions focused on finding robust solutions to challenges encountered by each program, such as how to improve PPE, obtain low-cost locally made PPE, and reduce time to don PPE during an emergency, as well as tips and tricks to improve communication between team members inside and outside the patient's isolation room. These debriefings were facilitated by PediSTARS senior mentors.

Postevent Survey Data Collection

An electronic survey was developed with the goal of gathering qualitative and quantitative data regarding the professional role of the participants and facilitators, the setting of the simulation sessions, patient locations where simulations were conducted, themes emerging from local debriefings, and organizational readiness (at the conclusion of the Simulathon) to accept COVID-19 patients if necessary (Table 2). An initial draft of potential survey questions was developed by 2 of the authors (S.T., V.N.) and subsequently piloted with senior Indian and international members of the PediSTARS to confirm comprehension, ease of completion, and suitability for qualitative analysis. Both quantitative and free-text responses were included in the final tool.

The final survey was distributed to facilitators using SurveyMonkey.[47] The web link of the survey was shared via e-mail and WhatsApp with all 380 PediSTARS-trained facilitators in India. Of these, 115 facilitators from 37 centers volunteered to conduct simulation training sessions during the National Simulathon for COVID-19. Thus, 30% (115 of 380) of the total potential facilitator pool participated, and 100% (115 of 115) of those completing Simulathon probes and the survey are included in the analysis. PediSTARS facilitators who were unable to conduct simulations during the specified period were excluded; their stated challenges included staffing limitations, inability to use PPE because of conservation efforts, and constraints on gatherings.

TABLE 2. Survey Questions for COVID-19 Preparedness

1. Name of institution, city and country:
2. Scenarios conducted in location: tick all applicable—emergency dept, OPD, OT, PICU, NICU, ward, other
3. Number of participants: doctors:__ nurses:__ others:__
4. Number of simulation facilitators: doctors:__ nurses:__ others:__
5. What went well? List 3 (free text)
6. What were the gaps identified? List 3 (free text)
7. Is your institution prepared to receive COVID-19 patients based on the simulation exercise this week?
8. Yes/no/not sure
9. What were the key simulation delivery and debriefing learning points for you and your team?
10. List 3 (free text)

OPD, outpatient department; OT, operating theater.

Webinar

A webinar to provide virtual support was conducted through interactive stream on YouTube (Google, Mountain View, CA) on May 4, 2020[48] to facilitate guidance and share with Indian simulation facilitators how international expert panelists from multiple countries and various patient care settings had prepared for COVID-19 patients. Information about the discussions collected during conversations and WhatsApp exchanges with lessons learned after the Simulathon was shared with all during a subsequent virtual webinar that was live streamed on YouTube on June 6, 2020.[49]

OUTCOME ANALYSIS

Qualitative data, including WhatsApp communications, debriefing data, and qualitative survey data were analyzed using thematic analysis techniques. Quantitative data were analyzed and presented descriptively.

COVID-19 Simulathon Outcomes

Several themes emerged from WhatsApp interactions with facilitators. Facilitators reported that the most useful discussions addressed low-cost adaptations of PPE; methods to reduce aerosol contamination by using a video laryngoscope inline suctioning; endotracheal tube clamping; and frequent disinfection of equipment. Many facilitators said that crowd control during "emergency resuscitation codes" was difficult and guidelines from the Children's Hospital of Philadelphia about how to minimize the number of providers involved in resuscitations were helpful.[50] Some facilitators said that they felt more confident after repeating the scenarios and adopting new resuscitation guidelines at their workplaces.

Survey responses were received from 37 Indian simulation programs (Fig. 2), with 1681 participants including 115 facilitators. Participants were nurses (828 of 1681, 49%), doctors (650 of 1681, 39%), and other HCWs (203 of 1681, 12%). All Indian programs (37 of 37, 100%) trained doctors and nurses in teams; 18 of 37 programs (48.6%) also included additional professionals or staff. One program trained 375 doctors, 274 nurses, and 102 other HCWs. Overall, the 37 programs trained a median of 4 physicians [interquartile

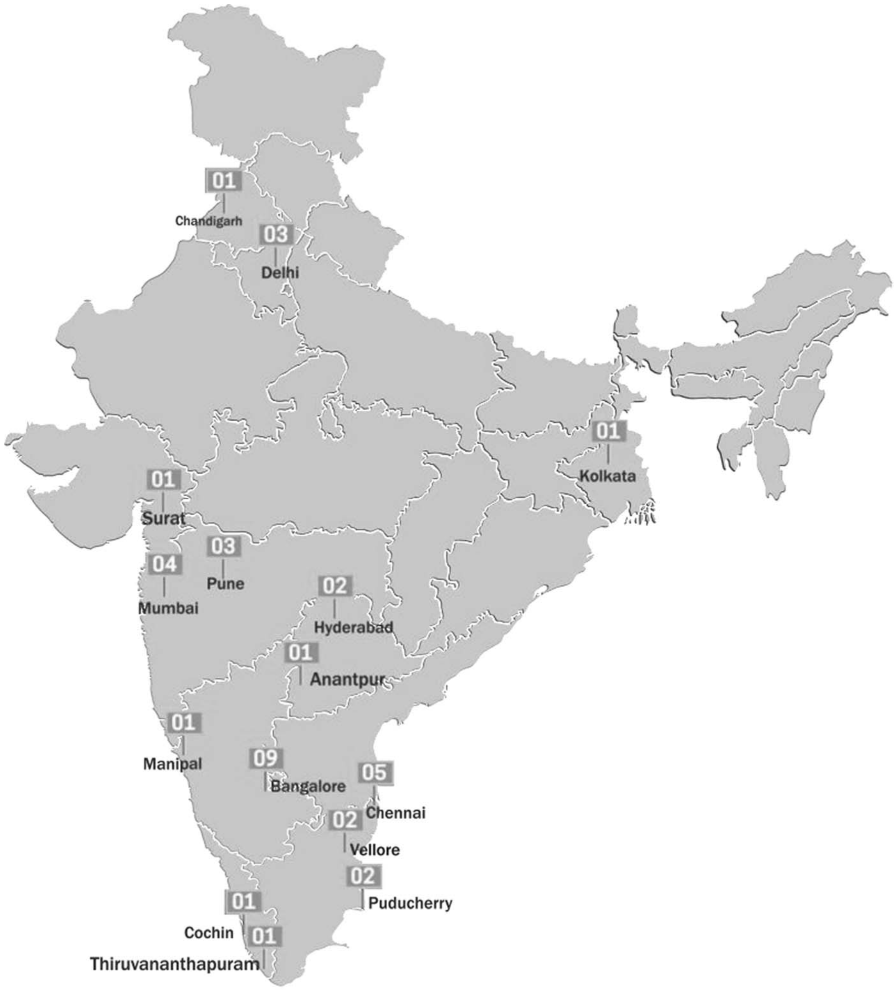

FIGURE 2. Location and number of the 37 participating programs in India. Please see SDC 1: list of centres in simulathon 2020.

range (IQR) = 5 (2–7)], a median of 4 nurses [IQR = 6 (2–8)], and a median of 0 other HCWs [IQR = 2 (0–2)]. A total of 115 [76 physicians (66%), 38 nurses (33%), 1 other HCW (1%)] facilitators led the simulations. More than half (21 of 37, 56.8%) of Indian programs conducted simulations in situ in EDs, and almost half (18 of 37, 48.6%) conducted simulations in situ in PICUs (Fig. 3).

Most programs (33 of 37, 89.2%) reported that they were prepared to receive COVID-19 patients by the end of the 30-day Simulathon experience. Facilitators reported enhanced ability to share their experiences, identify common problems, offer solutions, and improvise improvements in a timely manner. Additional themes emerging from the survey of Indian programs are summarized in Table 3.

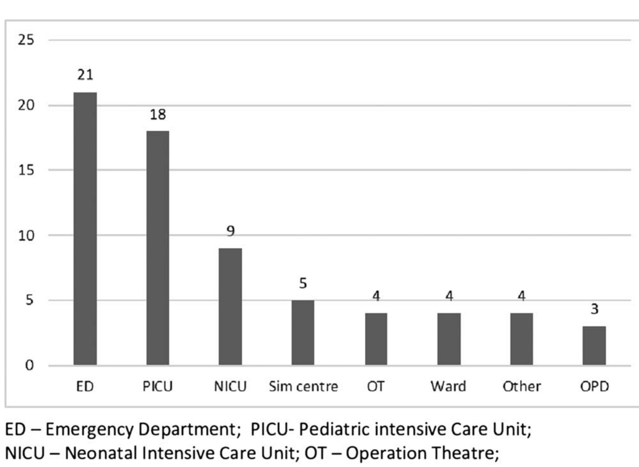

FIGURE 3. Location of simulation sessions. OPD, outpatient department; OT, operating theater; Sim Center, simulation center.

DISCUSSION

In this commentary, we describe the use of a 30-day national Simulathon period prevalence methodology concept using scripted and contextualized pandemic scenarios, concurrent social media facilitator peer support, secure social media group sharing of lessons learned, and simulation probe performance data collection that align with the disaster management cycle. The qualitative and quantitative data gathered effectively constituted the rapid needs assessment component of the model and enabled participating centers to address their own preparedness and mitigation strategies before the surge in cases later experienced in India. The scope of the Simulathon also assured the national relevance of the information gathered, allowing for a comprehensive approach to the large-scale implications of the pandemic. We also note that the Simulathon process aligns with other efforts to improve clinical practice and systems integration,[51,52] and the categories that emerged during the debriefing align with principles of human factors (ie, SEIPS 2.0)[53] and human-centered design (ie, SEIPS 3.0).[54] Our successful incorporation of SEIPS concepts within the Simulathon lends further credibility to the SEIPS model.

Our experience suggests that Simulathon methodology can feasibly inform pandemic preparedness at low cost within limited-resource settings. The concept of a national Simulathon period prevalence methodology that incorporated support for simulation facilitators via a mobile phone app was also well accepted in our context. Hence, we believe that this approach has far-reaching applicability and its adoption may assist other nations with significant regional economic variability in addressing epidemiologic issues. This is also the first report highlighting "work as simulated"[55,56] to identify capabilities and gaps in pandemic COVID-19 preparations in India. Dissemination of simulated scenarios with remote social media peer support for contextualization and conduct of these simulations assisted us in bridging otherwise unaddressed gaps in communication. Because simulation-based training for COVID-19 preparedness has not been conducted as a regular method of preparation in India, it is unfortunately difficult to interpret the effectiveness of this Simulathon on real process of care and patient outcomes. It is gratifying, however, that the vast majority of responding programs self-reported that their institution was prepared to receive COVID-19 patients after the Simulathon exercises, process evaluations, and resulting improvements. Future approaches to reinforce safe learning via simulation during the pandemic may include the application of remote or telesimulation[57] so that training can be offered to a wider array of healthcare professionals.

Implementation Challenges

At the time of the Simulathon, COVID-19 was a new disease of pandemic proportion, and little was known about the

TABLE 3. Plus/Delta Summary of Simulations in Indian Centers

Plus	Clinical skills	• Ongoing modification of aerosol precautions • Low-cost adaptations of PPE to be used in donning and doffing during simulation to preserve real PPE for patient care • CPR technique modified to require fewer providers Practice incorporated current PALS COVID-19 guidelines • Utilized safer intubation techniques with protective equipment, video laryngoscope
	Nontechnical skills	• Clear role designation • Managed to communicate despite hindrance by PPE
	Systems factors	• Participation of stakeholders to reduce gaps quickly • Able to use low-tech/low-cost manikins for in situ sessions
Delta/gaps/ challenges	Clinical skills	• Knowledge and skill gaps including CPR pauses and not knowing how to use defibrillators, viral filters, MDI via spacers, noninvasive ventilation, and dual-limb circuits; need to practice airway/intubation processes
	Nontechnical skills	• Difficult to communicate while wearing PPE
	Systems factors	• Lack of PPE for participants representing family members • Increased time to don PPE, especially when responding to emergencies • Lack of time to orient for new and changing care environments • Inability to access customized COVID-19 equipment for practice • Difficult to implement the more complicated transport flow for COVID-19 patients • Multiple sessions required to adapt and train for changing guidelines • Difficult to arrange adequate PPE for practice • Lack of availability of facilitators and participants, related to the lockdown, mandatory distancing, and staff conservation • Difficult to motivate HCWs to participate • Educating fearful or anxious potential participants
Lessons learned	Clinical skills	• Learning how to use video laryngoscope developed skills and confidence • Ability to implement current CPR guidelines for COVID-19
	Nontechnical skills	• Value of interprofessional training • How to limit personnel during emergencies • Adaptations, such as sign language and gestures, to overcome communication barriers caused by PPE and isolation rooms • Improved confidence and enthusiasm for actual patient care generated by preparation in teams
	Systems factors	• Ability to procure and customize equipment (eg, PPE, viral filters) for patient care • Increased familiarity with COVID-19–specific equipment • Developed bundles with customized medications and equipment (eg, COVID-19 intubation tray) for rapid access during emergencies • Practice contributed to refining processes • Developed processes for disposal of COVID-19–specific equipment and supplies • Developed a nursing position ("PPE buddy") to train and supervise PPE donning and doffing • Value of videos and visual aids (eg, how to don and doff PPE; how to intubate) prior for simulation exercise and actual patient care

MDI, metered dose inhaler; PALS, pediatric advanced life support.

diagnosis and management of the illness. This constituted our first real challenge. Because of evolving practice and the lack of prior knowledge or standard guidelines, it was difficult to script scenarios that could be applied for local preparedness of healthcare teams via simulation, and it took nearly 3 months to understand and standardize the simulation scripts for various settings. The implementation of lockdown, staff conservation, social distancing, deployment of senior staff to COVID-19 planning duties away from regular place of work, and cancellation of all routine or elective work including training also limited the availability of both facilitators and participants. Because of acute shortages of supplies (especially PPE), many hospitals refused to offer such equipment for simulation in an effort to save them for actual patient care. Although this was absolutely necessary, it did detract somewhat from the fidelity of the event. Significant fear surrounding COVID-19 also led many HCWs to go on sabbatical, and some were fearful of exposure to COVID-19 during simulation practice. Finally, the recommended airway management process modifications and needed ancillary equipment took time to mobilize.

Planning a Simulathon

Conducting a Simulathon requires buy-in from all the participating centers, especially facilitators and senior management or administration. Creation of a collaborative network (such as a WhatsApp group) with the basic understanding of peer-to-peer support, and the immediate availability and ongoing support of senior mentors, both play a vital role in ensuring successful implementation. We found that facilitators with limited time to design scenarios found it useful when scripts were written centrally and shared. Ongoing peer support also played a critical role. It is important to bear in mind the variability in the available resources for conducting simulations across various centers in low- and middle-income settings, and hence, low-cost adaptations and solutions will need to be implemented to each location's needs. Basing the event on a common theme or condition of the current relevance to participants can also assist in gaining support. Finally, the identification of local strengths as well as gaps in knowledge, skills, and human and system factors both encouraged centers and empowered them to make needed changes.

Although the 2020 Simulathon focused on the current COVID-19 pandemic, this is not the last disaster that our nation, or our world, will face, and the Simulathon process provides a robust approach to bringing simulation to bear in their mitigation. In addition to preparedness for pandemic events, the Simulathon process could be used as a healthcare emergency preparedness exercise for multiple types of natural disasters, such as severe environmental events (floods, storms, fires, earthquakes), accidental events (chemical spills, nuclear, and radiation leaks), and acts of terrorism including bioterrorism.

CONCLUSIONS

Successful disaster preparation and management are enhanced by adherence to the widely accepted disaster management cycle. India's PediSTARS successfully conducted a national COVID-19 preparedness Simulathon period prevalence intervention across 37 centers using standardized cases and novel social media (WhatsApp) peer support to address key aspects of this cycle. The Simulathon methodology was feasible and informative across India's variable and limited-resource settings. The results of this Simulathon proved useful to the Indian simulation community as it prepared for the initial COVID-19 surge and can serve as a template for the rapid conduction of disaster preparedness work in other low- or middle-income countries.

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