Remote Telehealth Aid During Humanitarian Crisis

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37.1 Introduction

Disasters may be natural or manmade [1]. Natural disasters include weather-related events, such as earthquakes, volcanic eruptions, and hurricane-driven flooding. Manmade disasters include mass shootings, violent extremism, CBRNE (chemical, biologic, nuclear, radiologic and explosive) events, and humanitarian crises related to military conflict or war [2]. Whether natural or manmade, both have the potential to overwhelm local, regional, or national resources. Accordingly, external aid may be required to meet basic health needs, address infrastructure, or deliver supplies including food, water, and medical therapeutics. Military aid may be required to restore civil order or protect aid workers and their supplies.

External aid may flow from different sources including, but not limited to, bordering or remote countries, non-governmental organizations (NGOs), medical professional organizations (MPOs), healthcare centers with their own teams, as well as

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well-intentioned independent medical personnel or private individuals who may have had prior military medic or combatant training. In-country team member safety and team security is assumed to be uncertain during active events such as violent extremism, government unrest, or warfare. Therefore, deploying independent healthcare teams to active warzones, as well as sites potentially impacted by military weaponry or combatant teams may be quite ill-advised. Nonetheless, healthcare professionals and others evidence a strong desire to help those in crisis [3]. One potentially viable option is remote aid when cognitive assistance as well as materiel sourcing may be of benefit.

37.2 Methods of Remote Healthcare

In many ways, remote healthcare has become synonymous with telemedicine. Particularly during the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, telemedicine has arisen as a viable means to monitor patient care when hospitalization is not required, convalescence after acute inpatient care or emergency department (ED) management, and wound healing when care was rendered far from the site of residence [4]. Telemedicine has blossomed in military experience by providing military role-2 (limited resources military medical facility from which frontline care units transfer patients for damage-control interventions and stabilization for eventual evacuation) consultative services. A form of telemedicine, telecritical care, blossomed during the SARS-CoV-2 pandemic because of a host of interwoven factors [5]. Local facilities were unable to transfer SARS-CoV-2 patients due to patient surge at more complex facilities; transfer was often limited to those who needed extracorporeal membrane oxygenation (ECMO) rescue, or post-injury care. In the USA, only half of all acute care facilities are staffed with intensivists, leaving unstaffed facilities in need of cognitive aid. As hospitals ran out of licensed beds, novel care spaces were developed and were often staffed with non-intensivists and non-intensive care unit (ICU) nurses, and non-ICU respiratory therapists and PharmDs using a tiered staffing approach [6]. Finally, remote evaluation of the need for transfer to a more complex facility leveraged telecritical care in the ED and inpatient spaces for patients suffering stroke and injury. Often, consultation was accompanied by education as well.

37.3 Methods of Remote Education and Communication

When in-person meetings and travel for MPO educational offerings were halted during the SARS-CoV-2 pandemic, remote learning leveraged rapidly with platforms developing including CISCO WebEx, Go-To-Meeting, Microsoft TEAMS, ZOOM, Apple FaceTime, as well as the video features of Facebook Live, and WhatsApp. Notably, platforms such as Twitter and self-assembled, often specialty

focused WhatsApp groups shared emerging medical news and science across countries, helping crystallize a truly global medical community. Digital platforms were also used for in-hospital consultation when non-essential clinicians were sheltered at home, especially in settings where a telecritical care system was already embedded. Similarly, those platforms were used for family meetings when visitation was suspended, an approach that allowed participants to see facial expressions that would have been concealed by a facemask and partly obscured by a faceshield [7]. Many platforms support multiple users, real-time video, screen sharing, and recording features. MPOs commonly used ZOOM and Teams for committee work and yearly educational congresses during SARS-CoV-2 pandemic years 1 and 2. Furthermore, telementoring during operative procedures also benefitted from the rapid growth of digital platforms [8].

37.4 Opportunities for Improvement with Remote Platforms

Using digital platforms to link remote parties requires all participants to use the same version. Depending on the specific needs being met, the display differences between desktop and handheld mobile device versions may be insurmountable (e.g., large volume of text, determining who wants to speak). Some platforms occasionally suffer from cross-device compatibility issues. All of the platforms remain subject to internet access and accessible bandwidth. For example, as schools moved to virtual education early in the pandemic, several platforms being used for telework, or telemedicine applications suffered repeated failures as a reflection of network overload. Moreover, session length may be subject to the license purchased, driving the need for creative scheduling to accommodate needs. Sessions may be readily recorded (with participant concordance) and repeatedly viewed, but are devoid of preplanned analytics (numbers of participants, poll data, time devoted to a specific activity, etc.). Furthermore, when used for telemedicine or telecritical care support, the data reviewed and recommendations generated do not easily integrate into the patient's existing electronic health record (EHR).

The desire to integrate the data from the recording, or the recording itself, in a seamless fashion remains elusive; incorporation as a non-searchable external document is currently achievable and not within all EHRs. Therefore, bidirectional data flow is not able to be met by any of the existing digital platforms, all of which would need to conform to Fast Healthcare Interoperability Resources (FHIR) interoperability standards as articulated by Health Level 7 (HL7), a standards development organization—standards which they were not designed to meet as their current use is an adaptation to an unforeseen healthcare need [9, 10]. FHIR standards are designed to facilitate the accurate and rapid exchange of clinical or administrative data to occur across different EHRs. Despite these limitations, digital platforms remain a viable option for providing remote aid during a humanitarian crisis.

37.5 Remote Aid During a Humanitarian Crisis

Regardless of the selected platform, digital linkage will need to find a mutually agreeable time to link parties across disparate time zones. This approach works well for planned conferences to discuss specific patients, review their care, and plan future care. Any of the conferencing solutions can meet this need. Groups will also benefit from establishing a roster of individuals who are willing to be available on-demand for impromptu consultation. This kind of linkage may occur across a conferencing platform, but may be more conveniently achieved across an app such as WhatsAPP that supports telephone conversation, face-to-face video calling, or text-based discourse for less critical exchanges.

A needs assessment is essential to match requested or desired aid with deployable resources including clinician specialties. For example, 'trauma surgery' in parts of the European Union may mean orthopedic surgery as opposed to what it means in the USA—a general surgeon trained in injury care and critical care. Additionally, translation between English and other languages may be required to facilitate aid. Desired aid may span five main domains: cognitive information (person-to-person), decision-making, care sequencing, technical advice, and published material (operative atlases, resource guides, textbooks, or other curated peer-reviewed literature). Providing informational material may be straightforward, especially with the prevalence of open access publications, as well as on-line texts. Rendering clinical care aid requires different approaches. Finally, cybersecurity concerns should be addressed, particularly when dealing with governmental entities.

37.5.1 Approaches to Providing Remote Aid During a Humanitarian Crisis

The easiest approach is voice communication by wired or wireless telephone. This option limits face-to-face discourse, enforces a limit on multi-person input, and precludes visual cues—an element that may be useful in addressing some differences between low-context and high-context cultures. Digital platforms may therefore offer specific advantages over voice only communication. Existing platforms have been previously mentioned and can clearly link participants, regardless of distance, for planned or impromptu discussion. However, all of them would benefit from a secure portal for data input for consultative team review ahead of that discussion. Such information may include deidentified patient information including images (radiologic and other) and may be shared across repositories such as Dropbox or a similar portal. Regardless of how that data is made available for the consultative team, current approaches do not support routine data analysis of uploaded information. Doing so requires a separate database and data entry person or persons. Data analysis is key to track major issues, follow a patient's clinical

course, and to perform interim and summative assessments of the impact of guidance on outcome, resource utilization, and the scope of consultation.

All platforms rely on stable internet access—a foundation that is uniquely subject to infrastructure destruction during disasters of short (earthquake) or long duration (war) [11]. Relatedly, when the internet link is unstable, the platform will be unable to be effectively used during active interfacility transport, or during evacuation from a Role 1 facility, a battlefield, or the site of explosion-induced building collapse [12]. If the platform is linked to a desktop, it may be unable to be effectively used for intra-op consultation. Moreover, care suggestions must be separately recorded by those requesting consultation using a program (or paper) as the platform does not provide a mechanism for recording and then exporting such information. Additionally, the success of consultation with one team may lead to scope creep, further making it quite difficult to capture the breadth of consultative work and its impact on patient care. Unsurprisingly, multiple teams may desire consultation in the same time frame based on their facility workflow and their time zone. These competing sessions articulate the need for more than one consultative team leader, an individual who may ideally be the Chief Medical Officer—especially when they can help with consultation—and not only administrative needs or resource allocation. An alternative approach that offers more functionality may enhance rendering remote aid.

During the height of the SARS-CoV-2 pandemic, several technology companies worked with the US Army Telemedicine and Advanced Technology Research Center (TATRC) to develop a stand-alone acute telecritical care platform [13]. The driving need for such an approach was the lack of uniform intensivist coverage across US acute care facilities, as well as the dearth of intensivists in Indian Health Service facilities. This program is termed the National Emergency TeleCritical Care Network (NETCCN). Its key features include that it is a stand-alone cloud-hosted program and app that is compliant with the Health Insurance Portability and Accountability Act (HIPPA). It demonstrates a double encrypted security feature as a minimum software requirement. The NETCCN app is handheld device-friendly with deployable tablet and desktop applications. Most importantly, it is an EHR agnostic method of providing critical care consultation to an ICU team. Clinical data may be readily captured for concomitant or retrospective analysis. An operational dashboard for tracking system level operational metrics and clinician efficiency supports data analysis. From a human factors perspective, there are specific spaces for uploading physiologic, laboratory, radiology data, and photos as well as entering progress notes paralleling common EHR domains (Fig. 37.1). Therefore, built-in workflows used by clinicians for routine care establish minimum training requirements. Digital video capture supports 1:1 connectivity for intraoperative consultation, as well as built-in ‘teams’ functionality allowing multiple disciplines to collaborate in care delivery. Finally, there is a section for individual patient follow-up in a fashion asynchronous from the initial consultation.

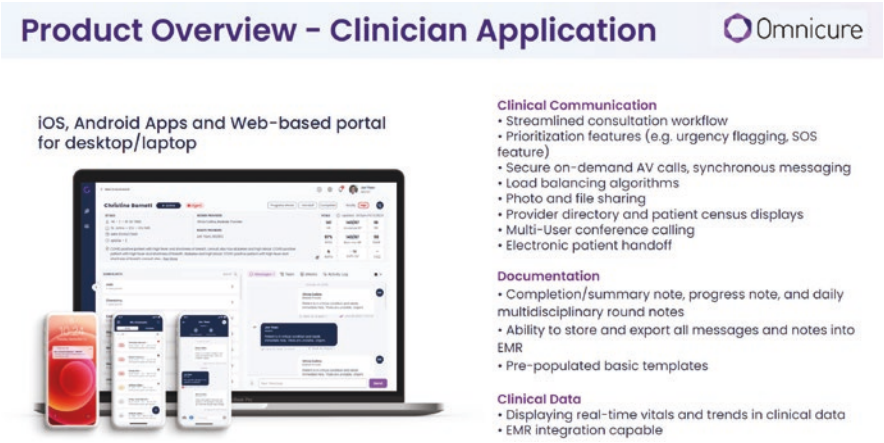

Fig. 37.1 The National Emergency TeleCritical Care Network (NETCCN) telemedicine application. This screenshot depicts the unique features of the working NETCCN app by Omnicure. Reproduced with permission from Omnicure Inc.; replication of content in print or otherwise is unlawful and subject to legal penalties

37.5.2 Barriers to NETCCN Telemedicine Application Adaptation for Remote Humanitarian Aid

The NETCCN telemedicine App was not initially planned for multiple people (>6) online at once, but this capability is already under development. As it was initially designed for US use with English-language speaking users, it is not loaded for translation across multiple languages. While programs exist, there is a financial cost to them—a cost that is avoidable with live translation. Downloading the app requires enabling country specific downloading by the app owner—a quite minor barrier. However, a major consideration is the need to implement geofencing for operational security for patients and clinicians during a humanitarian crisis. Additionally, the use of such applications in the European Union requires compliance with the General Data Protection Regulation (GDPR), which can impact rapid technology deployment.

37.6 Providing Materiel Aid

Both MPO and healthcare institutions or healthcare systems may seek to send supplies or devices to a disaster site. It is essential to accurately understand precisely what those at the disaster location need and can use, compared to what might be available to send. Often basic supplies, including the kind that were in short supply during the pandemic, are essential as their transport for regular resupply may be disrupted. Alternative means of transportation such as humanitarian aid agency-supported delivery may be required. Accordingly, having an aid organization, and a

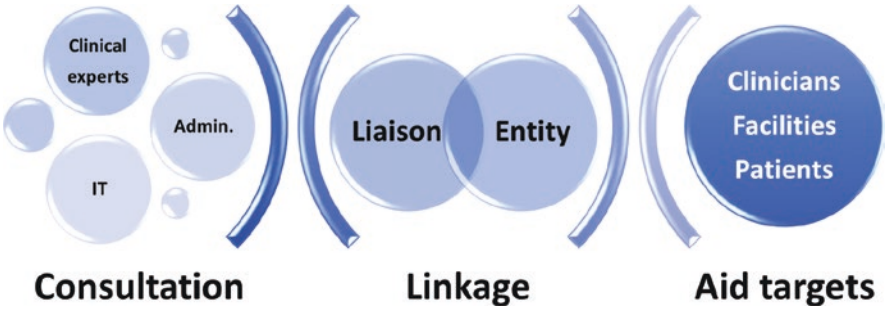

Fig. 37.2 Key team members for providing remote aid. This graphic depicts essential, but not all, team members involved in rendering remote aid. *Admin* administration, *IT* information technology

point person who serves as a liaison to help coordinate outreach and delivery is key (Fig. 37.2). Specific devices may also be important including additional ambulances or radiology imaging equipment. These are more costly, and an individual facility in or near a disaster zone may not have access to government funds to purchase what they need. Generous donations, including those from healthcare technology or device corporations, help address this gap.

37.7 Patient Sharing

When the care needed by a specific patient, or group of patients—such as those with burn injury—cannot be provided in local facilities, there is an opportunity for international rescue [14]. The World Health Organization has some pathways to facilitate the evacuation of unique patients to accepting facilities in other countries [15]. Similar arrangements may be crafted by an institution engaged in rendering remote aid. This kind of patient sharing may clearly identify the destination facility, but will not identify that facility as one that is providing remote consultative aid. Issues in repatriation, financial remuneration for care, rehabilitation, and more are outside of the scope of this chapter but highlight that international patient sharing is a vast endeavor.

37.8 Operational Security Issues

Operational security issues may be quite different in the aftermath of a natural disaster as opposed to a manmade one such as military conflict or war. In a natural disaster there is no or little need to avoid geolocation but there is always a need for cybersecurity. During a manmade disaster such as a military conflict or war there is a strong imperative to foil geolocation and to ensure effective cybersecurity [16]. Furthermore, an additional layer of security is required to preserve the identity of: (1) those reaching out for non-national aid, (2) the care facility, (3) patients, and (4) clinician family

members. Clinicians should be assigned code names or numbers, and patients may be sequentially numbered as well. A Virtual Private Network (VPN) should be routinely used to access the internet or other communication services.

Similar imperatives may be important for those providing consultation as well—a non-intuitive thought as clinicians commonly provide consultation as part of their workflow. Consultant facility information technology (IT) involvement is necessary to preserve network integrity. Some may wish to investigate the value of such consultative services—and then share those results in a medial professional organization venue followed by journal publication. It is imperative to avoid presentation or publication of potentially identifying data until after military conflict or war ceases. Some clinicians may also desire to travel to the disaster or crisis site to provide on-site aid. Such travel generally may require multi-level clearance including but not limited to the originating and host facilities, the traveler's government, and the disaster location's government. The individual's personal risk is high and should be evaluated in the context of a threat matrix [3]. Resources required for complex or even basic care may be depleted or absent; individual transportation of sufficient resources is not a viable approach based upon logistics, space, or cost. Since physical fitness is not an employment criteria for most hospital-based clinicians, individual or team physical fitness for austere environments may be lacking [17].

Individual travel places the clinician outside of the bounds of an official government or military asset. Therefore, official aid through embassy resources may be non-existent—especially if the embassy assets have already been evacuated. Therefore, safety and security issues abound and drive the need for contingency planning including evacuation, exfiltration, and potentially rescue. It is important to recall that highly trained clinicians from a remote country may be viewed as a high-value hostage and may be targeted for kidnapping as a means of exerting political pressure (especially if the travel is shared across accessible venues such as social media). Finally, one must beware of rendering advanced aid for which post-intervention resources may not exist (e.g., providing limb amputations in a setting where prostheses, rehabilitation, and ramp-based building access are not present) [18]. Despite the need for substantial operational security, there are a host of desirable outgrowths of remote aid collaborations that may come to fruition after the disaster has been resolved.

37.9 Potentially Desirable Outcomes

Certainly, scholarly investigations of tracked data provide an analysis and potential roadmap for future undertakings. More powerful is the opportunity for transnational and transcontinental collaboration enhancing education, clinician training (including exchange programs and fellowships), career advancement opportunities, and the development of a visiting scholar program. Regardless, perhaps the most impactful is participating in the reconstruction and reconfiguration of the infrastructure for local healthcare capability—an essential element of local regrowth after disaster-based destruction [19, 20].

37.10 Medical-Legal Considerations

Remote aid provides consultation, not direct medical or surgical care. As such, there are virtually no medical-legal considerations to address. Individuals who travel to disaster sites outside of an organizational structure engender many medical-legal concerns. Providing direct patient care outside of one's native country generally requires an appropriate license, or a waiver to needing that license, in order to engage in medical or surgical interventions. Failing to secure suitable permission to practice in another country generally leaves one individually liable for that care as unlicensed care in a non-native country typically falls outside of the boundaries of professional liability coverage. NGOs have pathways to navigate these considerations, and invited military members are covered by their armed forces policies. Since travel to a disaster zone may lead to personal injury, specific medical care coverage that also embraces medical evacuation is essential; many medical travel health insurance policies often cover *in situ* care including road traffic accidents but not transnational medical evacuation [3, 21]. Therefore, during protracted disasters such as war, remote aid is a particularly attractive approach to rendering humanitarian aid.

37.11 Conclusion

Remote aid during a humanitarian crisis is feasible and there are a variety of digital platforms that help individuals or teams to achieve that goal. Many of those platforms are currently integrated into social interactions as well as the business of medicine and medical professional organizations. The evolution and repurposing of existing telemedicine technology approaches that are clinical-friendly may offer significant advantages compared to current digital platforms but come at a small financial and large time cost. Time spent in reprogramming and reconfiguration may be substantial. Embedding translation programming that can work across multiple languages—as opposed to being purpose-built for two languages—is not yet standard. Every approach to rendering remote aid must embrace operational security for those providing as well as those receiving aid. In-person aid is a high-risk activity and benefits from specific planning and preparation that is quite challenging and may be insurmountable for an independent individual. There are a host of potential benefits to rendering remote aid that support and enhance local facilities that may blossom once the humanitarian crisis has been resolved.

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