Conceptual Framework for the Adoption of Innovative Health Technologies In Response to Health Emergencies

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Introduction: Rapid developments in healthcare technology can significantly improve the quality, availability, and immediacy of care in health emergency events; however, without a cohesive framework to conceptualize the interplay between emerging technologies, we risk creating silos, ignoring applications, and reducing interoperability between innovations.
Method: This framework was developed after reviewing the current literature regarding new technologies in healthcare assessment and delivery, discussing relevant innovations with experts, and analyzing global market trends in emerging health technology capabilities.
Results: Innovative health technologies deployed in disaster settings can be grouped by their relevance to (1) Disease and Injury Surveillance and Detection, (2) Population Protection, (3) Responder Protection, and (4) Disease and Injury Management. The first category encompasses technologies that help characterize the severity and scope of an event at its onset, utilizing a network of wearable devices, sensors, remote infectious disease sampling, and other tools. Once an incident occurs, technologies aimed at Population Protection are necessary to preserve the well-being of unaffected citizens. Scaled-up on-demand manufacturing for prophylactic medical countermeasures and needle-free delivery mechanisms for pre-treatments against CBRN threats will be paramount. Healthcare and emergency responders require additional support before and during incident response, especially just-in-time training through virtual and augmented reality, biometric monitoring, next-generation personal protective equipment, and enhanced communications capabilities. Finally, delivering care to patients in healthcare emergencies will require optimized allocation of scarce resources based upon acuity and survivability. Effective healthcare service delivery can be bolstered using Telehealth, autonomous patient transport, drone delivery, robotic and haptically guided care delivery, and decision support tools.
Conclusion: To effectively manage the successful adoption and implementation of innovative tools applicable to health emergencies, areas of impact and utility should be comprehensively categorized. This framework guides emergency managers, policymakers, and innovators alike to understand how individual developments coalesce in the larger context of disaster prevention, response, and recovery.

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Development of a Logistics System for Disaster Medical Container Operations Using Drones and GIS

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Introduction: To quickly operate a temporary hospital using disaster medical containers in the event of a large-scale disaster, dozens of large trailers must be quickly brought to the disaster site. This study aims to establish a logistic system for transporting and installing containers using drones and GIS.
Method: By linking drones and GIS, a theoretical model was created to quickly determine routes and installation sites for large trailers transporting medical containers from candidate routes simulated in advance by taking into account hazard maps and road conditions.
Results: Using this system, it is possible to

(1) Establish whether the roads planned to be passed through are passable.

By narrowing down candidate routes through preliminary simulations that overlay hazard maps and roads that are passable for large trailers, it is possible to narrow down the routes that need to be confirmed. Immediately after a disaster, a drone can be used to confirm road damage, flooding, landslides, etc., and map them on the GIS to determine the extent to which they are passable.

(2) Identify locations that take into account demand and safety.

Locations that are close to the disaster area, safe, and in demand for medical care can be determined and identified based on the population mesh and the damage situation.
Conclusion: GIS and drones have a high affinity and are used in various ways. However, there is still no linkage between GIS and drones adapted to medical care and logistics at disaster sites in Japan. This system is indispensable to comprehensively determine the safety and demand of roads and installation sites.

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Effects of an Early Detection System for Barotrauma During Hyperbaric Oxygen Therapy

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Introduction: Although hyperbaric oxygen therapy is required in disasters or emergency situations, barotrauma, which is the most common complication, continues to occur. If barotrauma occurs during hyperbaric oxygen treatment, treatment is stopped, and there is no proper preventive method for this. Therefore, the authors evaluated the degree of barotrauma prevention by applying a tympanometry-based anti-barotrauma device (ABT).
Method: The candidates of the clinical trial are adults between the ages of 18 and 65 who correspond to academic indications for hyperbaric oxygen therapy. In a prospective parallel design, the candidates were placed in the test group and control group. Simple randomization and one-sided blinding were applied. The medical staff directly observed the severity of middle ear barotrauma through a video otoscope. The number of treatment interruptions and completions along with findings from the otoscope observation (Grade 0~5) such as level of ear pain (pain scale value) were collected at three university hospitals.