

Disaster Medicine:

All-Japan Cross-industry Collaboration to Save Lives

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1. Symposium Background

In June 2024, the Japan Medical Association (JMA) held a symposium in Tokyo titled “Disaster Medicine for the Next Generation.” The JMA was founded by Baron Shibasaburo Kitasato, a Japanese physician, Japan’s father of modern medicine, and the individual whose likeness appears on the 1,000-yen banknotes newly circulated in July 2024. Through achievements such as successfully obtaining the first pure culture of the tetanus bacillus, Dr. Kitasato contributed significantly to the prevention of infectious diseases and the development of bacteriology in Japan and elsewhere. Believing that “the physician’s mission is to prevent illnesses before they occur,” he tirelessly stressed the importance of preventive medicine.

In line with Dr. Kitasato’s beliefs, the necessity for disaster prediction and preparation is emphasized as the key to disaster medicine whenever mass casualties occur due to natural disasters or terrorist attacks. Indeed, prediction and preparation are critical due to increasingly severe and frequent natural disasters resulting from climate change and concerns over massive earthquakes striking directly beneath Tokyo, in the Nankai Trough, and elsewhere. Seismologists advise that there is a 70–80% chance of a major earthquake occurring in the Nankai Trough within the next 30 years, with the estimated death toll surpassing 320,000. This constant risk of catastrophe renders disaster medicine initiatives an urgent issue for Japan.

The nation’s physicians, historically rescuers amidst mass casualties, funneled their heartfelt desire “to save as many lives as possible” into the planning of this symposium.

JMA President Dr. Kichiro Matsumoto issued a strong call to arms during his symposium address. “Disaster medicine is directly linked to saving lives. Medical practitioners must therefore unite with professionals from other fields in an all-Japan approach.”



The symposium represented a groundbreaking initiative for the JMA, uniting the expertise of meteorologists, civil engineers, and innovators from start-up ventures.

2. Dr. Yamaguchi: Disaster Medicine for the Next Generation

Dr. Yoshihiro Yamaguchi, symposium organizer and director of the JMA Emergency and Disaster Medicine Management Committee, maintains that “the physician’s mission is to save as many lives as possible.”

He has battled on the front lines of lifesaving endeavors where every moment counts, such as during the 1999 Tokaimura and 2011 Fukushima nuclear accidents. Following student training at Kitasato University Hospital and studies under global authorities at Harvard University and elsewhere, Dr. Yamaguchi moved on to treat and teach across the globe as an expert in disaster and emergency medicine.



During a pre-symposium interview, Dr. Yamaguchi described many personal experiences which left him with a sense of how inadequately medical care functions in emergencies.

“85.7% of the deaths in the Great Hanshin-Awaji Earthquake (1995) were immediate, as were 82.3% in the Great East Japan Earthquake (2011). Even if medical teams do their best to be on-site within 72 hours, less than 10% of lives can in fact be saved. I have treated injuries in countless wars and conflicts but have never felt as helpless as I did in the wake of the Tokaimura nuclear accident. We beseeched global authorities to incorporate cutting-edge medical care to treat fatally exposed workers but were ultimately at a complete loss. I was stunned by my own powerlessness as lives disintegrated—literally dissolved away—right before my eyes.”

While exploring the future of disaster medicine, Dr. Yamaguchi invited Nobuyuki Tamaki, the project leader of the Future Co-creation Initiative from Yokogawa Electric Corporation, to speak at the 2022 JMA symposium and, subsequently, to serve as general advisor to this symposium. Those encounters with Mr. Tamaki underscored the need for a future-oriented approach to emergency and disaster medicine by backcasting—starting from a vision of 50 or 100 years in the future.

During catastrophes, the Japan Medical Association Team (JMAT) and the Disaster Medicine Assistance Team (DMAT) clearly represent invaluable disaster medicine resources. Nevertheless, survival rates would surge if families, communities, and societies planned for, rather than simply responded to, disasters. As a professional in emergency medical intervention at disaster sites, Dr. Yamaguchi is determined to engage in cross-professional collaboration to explore the potential of next-generation disaster medicine.

Dr. Yamaguchi's view is shared by Dr. Hidekazu Hosokawa, a member of JMA's Executive Board, who noted, "We are seeing advances in the technology generating meteorological information which predicts extremely damaging torrential rainfall. The JMA's active involvement in sharing and using this information would ease the burden on local medical entities."



The symposium began with the presentation of a case study from Aoyama Hospital, which was recently hit by one of the most severe rainstorms in recorded history.

3. One of the Heaviest Rainstorms on Record—Lessons from Aoyama Hospital Flood Damage

On June 2, 2023, Toyokawa City in Aichi Prefecture experienced 423.3 mm of precipitation, the heaviest rainfall on record for a single day. Fortunately, both patients and staff of Aoyama Hospital escaped injury, but the first floor of the hospital flooded. The magnitude of the damage necessitated renovation of the facility.

Hospital Director Yoshiyuki Komori explained the chronology of the flooding as well as how nurses and other staff members collaborated on recovery work to overcome the situation. The hazard map for the area reveals that the hospital is situated in a flood zone.

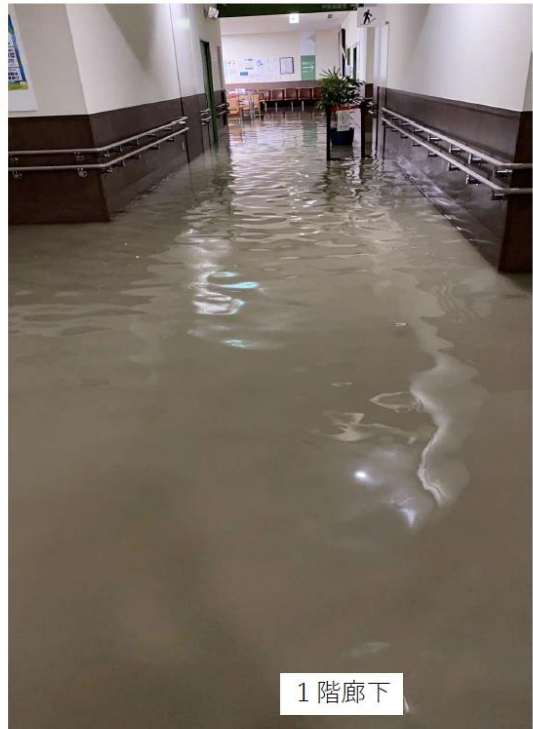


According to Director Komori, the lessons learned from the experience included acting upon climate and flood information and improving flood countermeasures for medical equipment (such as CT scanners, precision equipment, and supplies), disaster headquarters, and business continuity plans (BCPs).

6月3日(土)
1時 院内15センチ位浸水
4時 院内30センチ位浸水

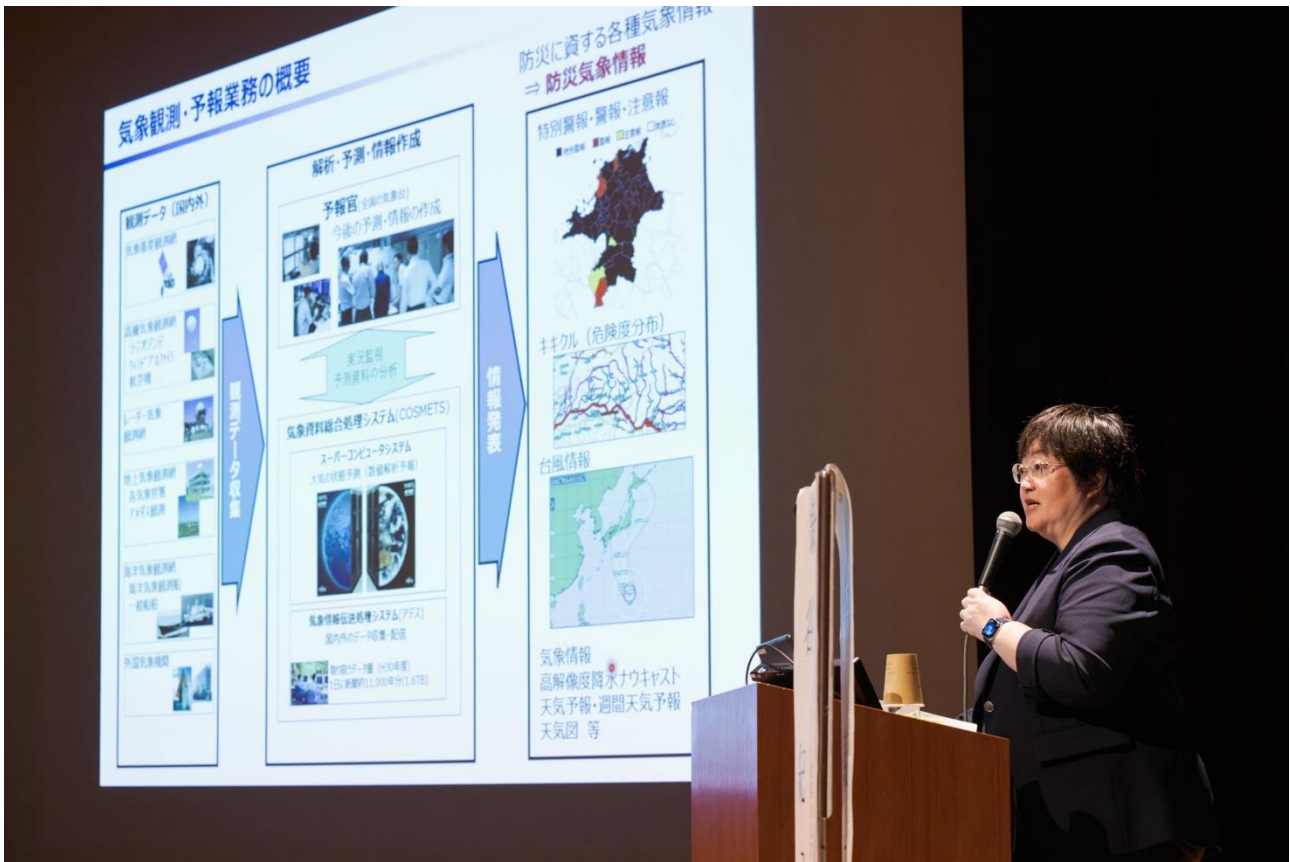
0時には雨は小降り
1時には降りやむ

6月2日(金)の降水量
豊川市 423.3ミリ
豊橋市 418.0ミリ
田原市 400.0ミリ
蒲郡市 341.5ミリ



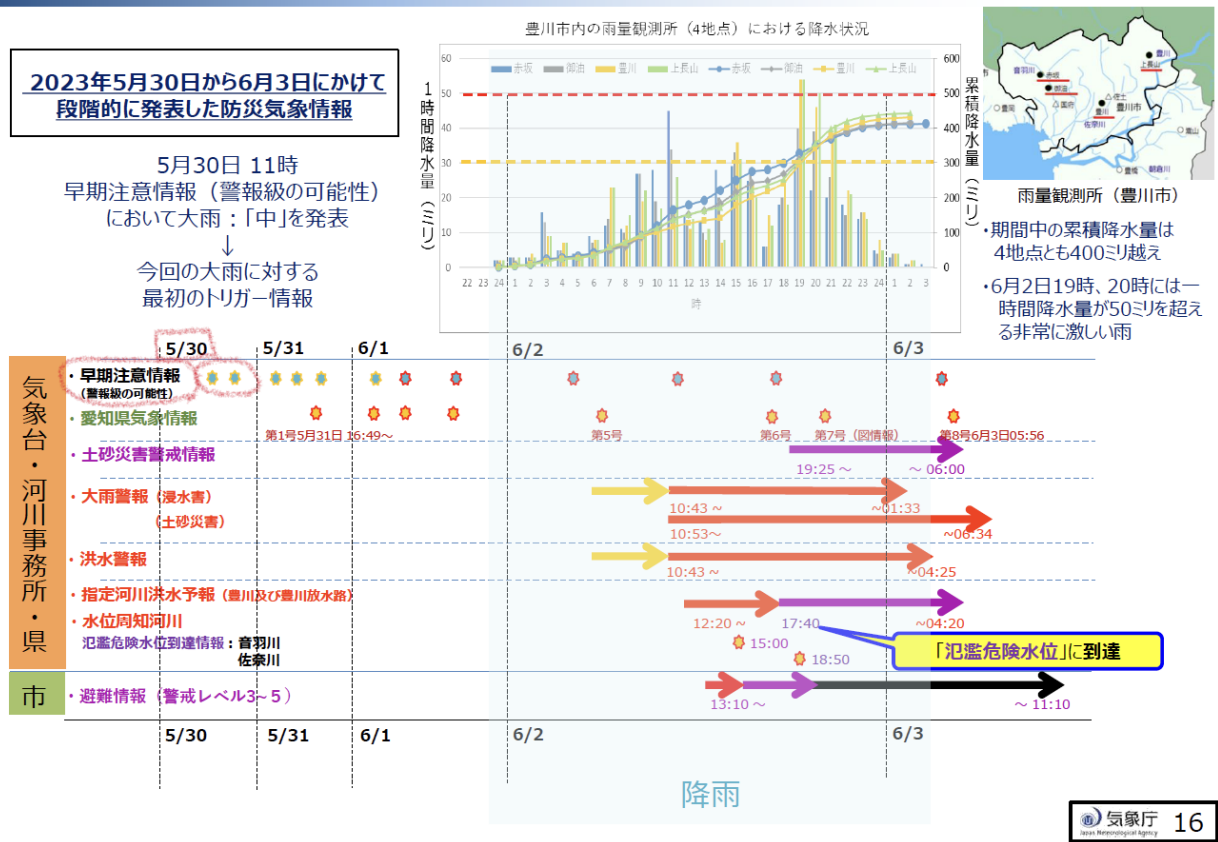
4. Japan Meteorological Agency's Bulletin Predicts Torrential Rain

Speaking on behalf of the Japan Meteorological Agency, Noriko Kamaya underscored the importance of leveraging disaster-prevention weather information. The Agency's history includes about 150 years of weather-station observation and some 70 years of weather-radar usage. Although weather cannot be predicted with 100% certainty, the Meteorological Agency's dispatches are an important source of weather information. An excellent example of that is the Agency's prediction of the torrential rainfall in Toyokawa, as described by Director Komori.



“Both heavy rain and flood warnings were issued in advance of the June 2 deluge. Furthermore, on May 30, three days before the heavy rainfall, the Japan Meteorological Agency issued an early warning indicating the possibility of warning-grade rainfall,” Ms. Kamaya reported. She further emphasized the importance of grasping the heightened danger level announced on the agency’s website and responding quickly.

豊川市の防災気象情報発表状況（時系列）



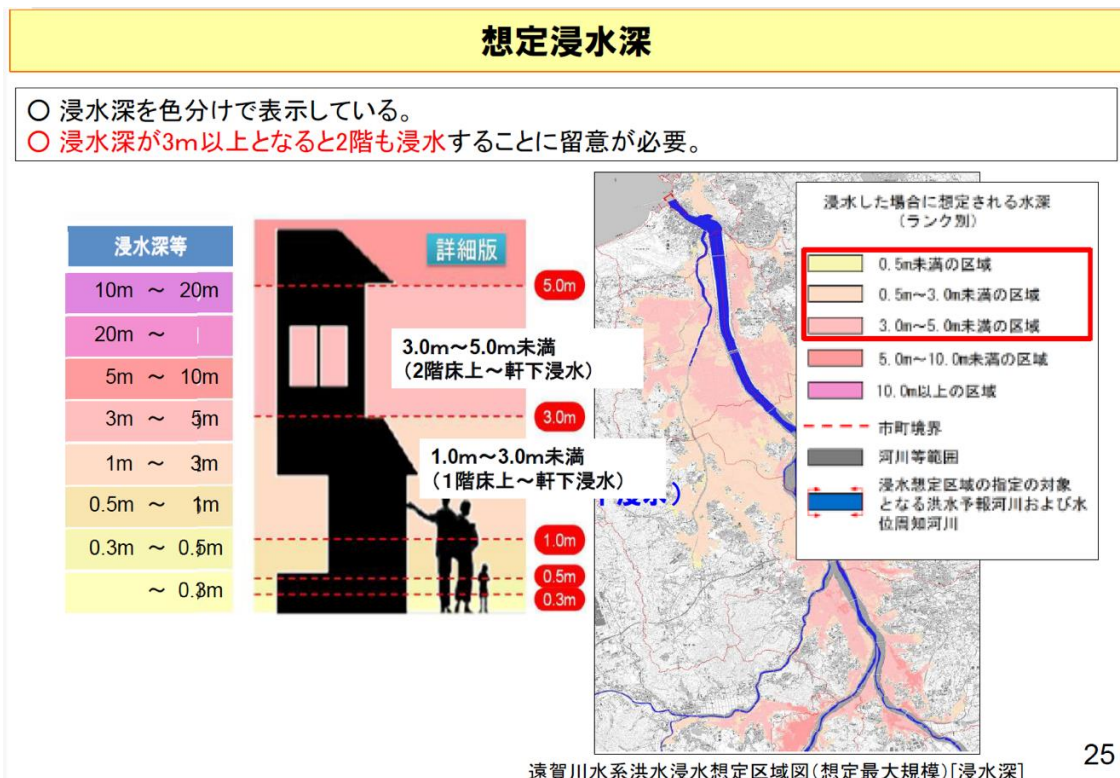
For example, the Meteorological Agency provides an online risk map titled *Kikikuru* (loosely translated as “encroaching crisis”), which predicts the risk of a disaster from heavy rain. Updated every 10 minutes, the map ranks real-time flood damage risk into five color-coded levels. *Kikikuru*, accessible on computers and smartphones, forecasts three types of disaster: landslide, inundation, and flooding.

5. Hazard Maps: Tools for Assessing Local Risk

Hideyuki Ashiya from Japan’s Ministry of Land, Infrastructure, Transport and Tourism (MLIT) advocated for the usefulness of predictive tools and hazard maps, stating that “floods are unavoidable, but flooding does not necessarily mean damage will occur.” Hazard maps illustrate areas where disaster risks such as floods, landslides, and tsunamis are predicted, and identify evacuation sites.



Areas which hazard maps identified as likely “inundation zones” overlapped almost perfectly with areas deluged in the 2018 West Japan Floods, which resulted in over 200 victims. This example reinforces the importance of using hazard maps to help plan actions in advance of disasters.



Mr. Ashiya also touched on climate change, highlighting that Japan currently sees about 1.4 times the excessive rainfall events of the 1970s. He added that if global temperatures rise an average of 2 degrees, Japan will see 1.1 times more rainfall. Mr. Ashiya explained that future risk will escalate to critical level, with river volume swelling 1.2-fold and heavy rains doubling in frequency.

Mr. Ashiya called for integrating hard and soft measures going forward. “If we seek full responsiveness to climate change, levees alone will likely not suffice. In addition to maintaining dams and levees, we must implement river basin flood control throughout each region, such as by building storage facilities in towns and sustaining forests upstream of rivers.”

6. Tokyo—Risks Associated with Below Sea-level Topography

Nobuyuki Tsuchiya, who holds a PhD in engineering from the Japan Riverfront Center, is an expert in flood countermeasures and well versed in urban development and river projects through his former experience as a member of the Tokyo Metropolitan Government.

According to Dr. Tsuchiya, predictions suggest that “a tidal surge in Tokyo Bay would cause 188 hospitals and 3,449 clinics in the metropolis to be submerged,” which would affect 59% of the capital’s hospitals and 49% of its medical clinics. “Diverting groundwater for industrial usage has caused land subsidence, resulting in much of the capital’s acreage being at sea level during low tide, with some areas even falling below sea level. That suggests that a storm surge might affect 66% of Tokyo’s hospital beds.”



Dr. Tsuchiya reflected on an evacuation call he issued when predicting flooding of the Tama River.

“Only six out of 1,800 individuals evacuated. Even during the 2018 West Japan Floods, only 4.6% sought refuge. That means 95% of individuals will not evacuate. This absence of crisis awareness is the major cause of an upswing in disaster victims. Regardless of efforts invested by the Japan Meteorological Agency, the MLIT, or the Japan Medical Association, we alone cannot achieve zero disasters. We need a “consciousness revolution.”

Dr. Tsuchiya also presented the other side of the coin by introducing the example of Juntendo Hospital, which continued medical operations, undisturbed, during heavy rains in Saga Prefecture. The hospital had elevated its foundations in accordance with flood predictions shown on hazard maps so that its first floor could avoid submergence.

Dr. Tsuchiya stressed the importance of taking advantage of information. “If hazard maps are put to use, we may be able to reduce the number of flood casualties to zero.” He concluded by accentuating that “collaboration among civil, architectural, mechanical, and electrical experts as well as administrative staff is vital in creating hospital BCPs.”

7. 2050—Our Future as Global Warming Advances

Professor Takashi Sekiyama, a Kyoto University expert on climate security, addressed future risks: “I must emphasize that climate change may further exacerbate the severity and frequency of natural disasters.” He added that the Japanese government estimates that if temperatures rise 2 degrees compared to the 19th century pre-Industrial Revolution level, quick torrential rains bringing 50 mm of hourly precipitation may increase the current rate 1.6-fold. “A 2-degree temperature rise is not that far off,” he warned. “Last year, in fact, the planet already marked a 1.45-degree rise in average temperature.”



That was not the only astonishing prediction Prof. Sekiyama shared with his audience: “According to forecasts by the UN’s Intergovernmental Panel on Climate Change (IPCC), the temperature is expected to rise 1.5 degrees within a few years, reaching a 2-degree elevation somewhere around the year 2050. Even if we were to succeed in becoming carbon neutral by 2050, further global warming might well be unavoidable.”

Prof. Sekiyama stressed the need for disaster countermeasures, assuming future elevated risk of damage from torrential rainfall. He asserted that individuals need to prepare for disasters by taking advantage of information on hazard maps and the Meteorological Agency's *Kikikuru*, while stakeholder organizations should enhance collaboration (such as disaster-relief initiatives by medical associations and the Japan Self-Defense Forces).

8. Incorporating Medical Safety into Urban Development

Professor Takaaki Kato of the University of Tokyo is an urban planning expert and a leading authority on community planning for disaster prevention. He conducts urban disaster simulation research and liaises with local governments on disaster prevention-based community development.

He began his remarks by expressing grave concern that Japan “is entering an ‘era of disasters,’ including a major earthquake directly beneath the capital and in the Nankai Trough.”

Prof. Kato went on to explain that about 40% of Japan's hospitals are located in flood-prone areas, putting them at high risk for damage during heavy rains. In urban planning, one must keep in mind that hospitals require spacious building lots, making complete avoidance of hazardous areas difficult. One countermeasure, Prof. Kato explained, is the Concept of Urban Grand Design for Adaptable City to Flood, a roughly 20-year ongoing project involving collaboration among industry, government, and academia.



Prof. Kato commented that “we are studying the creation of flood-adaptable neighborhoods and buildings in our urban planning. Our city has spaces designated for evacuation and independent lifeline capability. Victims of disaster-stricken surrounding areas could come here for water, power, and information. This can help save lives. If hospitals must be built in hazardous areas, we need to understand the risk and ensure they can withstand disasters.”

Prof. Kato went on to explain the 2023 launch of a microgrid (an energy system enabling small local areas to operate power self-sufficiently during widespread disaster-generated outages) in Chiba Prefecture’s Isumi City, with a power lifeline technically capable of operating self-sufficiently. He also introduced the concept of a Disaster Independent Lifestyle Zone, in which a community can ride out a disaster without relying on external assistance.

Finally, Prof. Kato cited deficient ambulance transport and medical institution capacity in Tokyo, and sounded the alarm that Japanese society must face this reality. “Estimates suggest there may be 90,000 victims in the event of a Tokyo inland earthquake, 10,000 of whom may be seriously injured,” he reported. “As only 2,100 of those could be transported by ambulance within 12 hours,

demand completely exceeds current capacity, signifying the need for a total change in the structure of the current social system.”



9. A Lifesaving Society Enabled by Cross-industry Collaboration

Finally, Yoshiki Hiruma of the Development Bank of Japan Inc. explored possibilities for “Structuring and Designing a Lifesaving Society,” with collaboration in disaster medicine across the technology, industry, infrastructure, and service-sector industries. Mr. Hiruma has studied urban disaster mitigation/management as well as social innovation and has served on internal and external advisory committees on disaster prevention, BCPs, crisis management, climate adaptation/resilience countermeasures, and financial technology. In 2015, he was named a Young Global Leader by the World Economic Forum.



Mr. Hiruma suggested that Japan gains advantages from being a major disaster-prone nation: “We have overcome multiple national crises and disasters. As the characters composing the Japanese word crisis (危機) suggest, skillfully managing ‘danger’ (危) has allowed creation of ‘opportunity’ (機). We flipped a mental switch and began preparing hardware for both ordinary times and disaster situations, anticipating risks, creating predictive information, and speedily dispatching warnings. We formulated new systems. Japan has created frameworks for a variety of disasters. All these efforts are the wisdom accumulated by our ancestors.”

Mr. Hiruma emphasized that “preventable deaths during both normal and emergency situations are not merely issues for the medical community but for the entire society. We can solve this by improving relationship vulnerabilities among individuals, families, communities, and societies that are often isolated, an essential factor in creating lifesaving societies. The key is not to pursue optimization within segmented fields, but rather to have medical and other specialists establish increasingly tight collaborations.”

Some of the venture companies participating in the symposium introduced innovative technologies and services with potential roles in disaster medicine, as noted here.



SkyDrive Inc.: Cargo Drones and eVTOL

1. SkyDrive Company Overview



Our Products

eVTOL

SkyDrive allows you to fly freely on a daily basis.

- The sound is less noticeable than that of a car, integrating it comfortably in your life.
- The lightweight design of the aircraft enables the use of building rooftops as take-off and landing locations.
- Significant reduction in aircraft manufacturing and maintenance costs.



Drone

Cargo Drone and Entertainment in the Sky.

- Automatic transportation through the sky, even in environments with altitude differences
- Launch of drone show business to bring the sky closer to the people.
- High level of safety using knowledge gained from the development of flying cars.



8

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SkyDrive is developing cargo drones and eVTOL. In response to a request by Japan's Ground Self-Defense Force, the company engaged in disaster relief work following the January 2024 Noto Peninsula Earthquake, sending its cargo drones as survey flights to assess damage in isolated communities as well as to transport the emergency relief supplies.

WOTA CORP.: Small-scale Decentralized Water Reuse Systems

WOTA is a start-up originating from the University of Tokyo, and it is working to tackle structural solutions to water problems. The disaster response efforts were initiated to help deal with the heavy rainfall in western Japan in 2018. WOTA introduced a prototype water circulation system to areas where many disaster victims had been unable to bathe for two weeks during the midsummer heat.

The small-scale decentralized water reuse system recycles and circulates over 98% of household wastewater, making it available for use. The company has a proven track record of providing showers and handwashing facilities during disasters on multiple occasions.

During the Noto Peninsula earthquake that occurred on New Year's Day this year, the company deployed approximately 100 units of portable water reuse system 'WOTA BOX' and about 200 units of water reuse hand-wash stand 'WOSH' to 84% of the evacuation centers which had experienced the long-term water outage and 68 hospitals and care facilities, providing support for bathing and handwashing.



CROSS SYNC. INC: Telemedicine

CROSS SYNC is a certified venture launched by Yokohama City University. Using iBSEN DX, its biometric monitoring app, the company is building a system to enable early detection of abnormal symptoms in the medical setting, identifying individuals with potential risk among multiple patients seeking assistance.

Some 61% of medical errors in the ICU stem from failed patient observation or communication breakdown. The app enables medical professionals to evaluate patients remotely, with potential for usage in disaster-area medical care.



Vacan, inc.: Visualizing Facility Availability Information

VACAN is developing an IT platform enabling visualization of facility availability. The app would normally provide users with the availability of restaurant seating, restrooms, and other facilities in public and private institutions, such as schools and shopping malls. During disasters, however, such information would help users find vacancies at evacuation sites more easily.

Track record of introducing services to shelters

Evacuation center visualization services have been implemented in more than 200 municipalities and 10,000 evacuation centers in Japan.

of municipalities: **200** or more

of evacuation centers: over **10,000**



VACAN

10. On Becoming “Good Ancestors”

The future of global warming is already upon us. The June 2024 symposium repeatedly underscored the importance of comprehending disaster risk and ensuring readiness through close liaisons between national and local entities.

Dr. Yamaguchi hopes that “50 or 100 years hence, this symposium will be remembered for having generated a butterfly effect with propitious results.” As “good ancestors,” we can ensure a better world for future generations.

Today, the bright ray of hope for Japan amidst disaster-borne uncertainty is that Dr. Yamaguchi’s challenge to coalesce all-Japan, cross-professional expertise holds the potential to be a game changer for disaster medicine.

(Reporting/Editing by H&K Global Connections Inc.)