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Editorial

Are IVF Clinics Ready to Deal with Any Potential Crisis or Disaster?

In the quality management programs of healthcare systems and hospitals, there is a special focus on emergency preparedness and risk management as a requirement in preventive action plans. IVF clinics are at the forefront of this attention. The vulnerability of IVF clinics to various threats, including regional wars and conflicts, natural disasters and crisis, power outages and cyberattacks, is greater compared to other healthcare facilities. In addition to planning for protection of patients and staff in IVF clinics, special considerations and measures are necessary due to elevated vulnerability of stored biological materials and the irreparable loss of gametes, embryos, and reproductive tissues. The loss or threat to stored biological materials in IVF clinics has significant legal and emotional consequences for the patients, service providers, and the healthcare system (1).

IVF clinics should implement a range of comprehensive strategies, to ensure the safety of staff and patients as well as the continuity and security of reproductive materials in emergencies, through delineating fundamental principles of accreditation, quality management, and experiences from past incidents and disasters. Accreditation and quality management systems (QMS) play a key role in emergency preparedness. IVF clinics are always advised to operate with the core principles of accreditation, even if they are not formally accredited. Formal accreditation as a requirement provides a framework and principle of proactive planning to withstand disruptions and protect critical reproductive care services. A robust QMS, as a quality framework, is essential to govern all operational practices and manage potential risks. Professional societies such as ASRM, ESHRE, SAR, and SRBT emphasize that such systems must address: ensuring the safety and protection of staff and patients; maintaining the safety and viability of fresh and frozen biological materials such as embryos, oocytes, sperm, and tissues; protecting and securing critical data including patient and laboratory records, financial documents, and equipment; and finally establishing clear guidelines for continuing or discontinuing patient treatment. All these plans require "all-hazards" risk assessment encompassing pandemics, natural disasters (*e.g.*, fires, floods, earthquakes, hurricanes, and blizzards), power outages, terrorist attacks, cyberattacks, and equipment failures (1-3).

IVF clinics are recommended to establish procedures to monitor adequate liquid nitrogen (LN2) levels and temperatures in all critical storage containers. This includes checking dewars at least three times a week or using continuous electronic monitoring systems with 24-*hr* remote alarms that immediately notify personnel if critical values are reached. For faster response to vacuum failures, LN2-immersed level probes are preferred over vapor-immersed temperature probes. An adequate supply of LN2 should be maintained on site, possibly including double ordering in anticipation of shipping delays. LN2 availability must be evaluated by risk assessment programs, which may be achieved through agreements with other facilities to share the costs of an LN2 generator. It is preferable to visually inspect the tanks for damage such as sweating, cracking, or rust, and any tank losing LN2 faster than expected should have its contents transferred to a spare tank and replaced. It is beneficial that the new storage tanks undergo a rigorous 30-day performance validation process, including thermal imaging, dual probe temperature checks, and weight monitoring, before being put into active use. Access to cryo-storage tanks and the LN2 source should be limited to authorized and trained personnel. Furthermore, tanks are advised to be located in well-ventilated areas, and oxygen monitors with audible and visual alarms are essential to detect hypoxic environments caused by LN2 release. Moving LN2 tanks to a safer location is recommended if there is adequate warning of an impending emergency. These new locations need to be secured and marked so that non-medical personnel (*e.g.*, fire, police) can easily identify them, and the relevant authorities are notified in advance. In fact, moving large tanks is more difficult and requires careful planning (1, 4, 5).

In crises and disasters, operations should be hibernated, new cycled halted, and all gametes and embryos immediately frozen until the implementation of safe strategies. Emergency freezing of day zero to day five (D0-D5) oocytes and embryos is a safe and effective protective measure during disasters. For example, during the Zhengzhou flood in 2021, 1,246 oocytes and embryos from 155 patients were successfully frozen with only emergency power supplies. Similarly, during the 2025 Iran-Israel twelve-day war, oocytes and embryos were frozen at all IVF clinics in war-involved areas. In some cases, embryologists may strategically freeze and store D0/D1 embryos to reduce the potential risks of freezing (4).

Duplicate records for recognizing sample ownership should be maintained in a secure location separate from the primary storage site, ideally off-site or on a secure web server for proper data management and security. In the event of power outage or cyberattack, paper documents become critical for patient and embryology records. Printing electronic documents in preparation for anticipated disasters is a good strategy. Healthcare organizations are vulnerable to cyber threats, so emergency plans must include protocols for complete computer shutdown, with a focus on recovering electronic medical record (EMR), laboratory systems, and imaging archive modules that are critical for resuming normal clinical practice. Moreover, staff training in manual documentation and procedures is essential. Recruiting adequate staff for all clinic procedures and emergency response who receive emergency preparedness training commensurate with their job responsibilities is a great step in emergency plans. Announced and unannounced maneuvers should be conducted periodically to educate staff on safety features, evacuation plans, and to test their ability to execute the emergency action plan. In addition, clear and prompt communication from management is critical to support staff (1, 3).

A proper policy to diminish the risks of power outages in disasters, incorporating UPS systems for providing 6–8 *hr* of full-load operation, and on-site generator fuel for at least 3–4 days of continuous operation represent optimal practices in IVF clinics. Ensuring a suitable and uninterrupted power supply of incubator gases, including pre-mixed gas compositions, is critical to maintain ideal culture conditions. Adequate stocks of consumables (*e.g.*, 3 months of supply) should be maintained and substitute and pre-evaluated suppliers be identified to minimize supply chain disruptions. It is suggested to properly secure equipment against potential damage and to ensure alarm systems notify personnel of their malfunction or adverse environmental conditions. Re-validation of equipment after a period of non-use in emergencies is also essential (1, 4).

IVF clinics are encouraged to establish formal "mutual support agreements" with one or more nearby clinics to ensure continuity of care during crises. A growing number of centers are relying on off-site commercial storage facilities for long-term storage of frozen samples. These facilities are specifically designed to protect samples from disasters and provide climate-controlled environments, 24-*hr* monitoring, and strong security. Professional cryogenic shipping services are necessary for safe handling of biological specimens. Patients should be promptly informed via consent forms about the location and status of their stored samples, that they may be transferred to other centers in the event of an emergency, and that any compromise or destruction of tissue will be reported and documented (2, 3, 5).

All in all, IVF clinics need to learn from the past. The COVID-19 pandemic highlighted vulnerabilities in the supply chains of personal protective equipment (PPE), consumables and LN2, as well as staff shortages and travel restrictions. This culminated in widespread interruptions of elective treatments globally and increased reliance on telemedicine for consultations. In another case, the NYU Langone Fertility Center in the United States experienced a power outage and its backup generator failed. However, the use of UPS units was crucial for the emergency preparation and freezing of 90 embryos, resulting in 11 live births. The center also relied heavily on its local network of IVF clinics to manage patients for oocyte retrieval, resulting in 10 live births. During Hurricane Katrina, severe flooding restricted access to frozen embryos to boat transport only, making re-entry into the city impossible for extended periods and causing the loss of embryos in incubation. All disposables had to be discarded before IVF services could be resumed. The war in Ukraine severely impacted IVF clinics, causing infrastructure disruptions (*e.g.*, power outages and clinic damage), endangering biological samples, and creating physical and logistical challenges for maintaining operations amid blackouts and airstrikes. A documented case involves Dr. Anna Sokalska, a faculty member of Stanford University, who coordinated the transport of oocytes and embryos from Kyiv to a clinic in Poland in March 2022, and performed extraordinary efforts to protect vital reproductive material and continue services despite the enormous difficulties caused by the war (1, 2, 4, 6).

In conclusion, the continuity and protection of reproductive materials in IVF clinics mainly rely on careful planning, adherence to accreditation principles, continuous monitoring of critical systems, robust data management, staff training and practice, and the establishment of mutual support networks and off-site storage solutions. Learning from past emergencies will continually refine these strategies and prepare facilities for the unpredictable challenges of the future.

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