Quantifying Disaster Resilience of Critical Infrastructure-based Societal Systems with Emergent Behavior and Dynamic Interdependencies

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Abstract: This proposal focuses on the resilience of critical infrastructure-based societal systems (CISSs) that are necessary for community functioning. A CISS is comprised of *interdependent* buildings that together serve a community function and that are *dependent* on networks of critical lifelines (water, wastewater, power, natural gas, communications and cyber, and transportation). They are a family of structures that are linked by occupancy type, people, policies, information, geographic location, and/or building services, and thus also rely on human, organizational, political, and cyber links. We propose to create analytical capabilities to support the quantification of resilience of a CISS under multiple, potentially compound hazards. The developed risk quantification framework with supporting computational techniques, along with risk communication strategies, cyber protocols and other developed adaptive actions that can be taken to prevent nonlinear escalation in hazard event impact, will be demonstrated on the healthcare system. Assessing the performance of a CISS and understanding the complex nature of its interdependencies will result in a deeper understanding of individual communities' vulnerabilities to future hazards.