CONVERGE COVID-19 Working Groups for Public Health and Social Sciences Research

Research Agenda-Setting Paper

This paper was written to help advance convergence-oriented research in the hazards and disaster field. It highlights areas where additional research could contribute new knowledge to the response to and recovery from the pandemic and other disasters yet to come. Questions about the research topics and ethical and methodological issues highlighted here should be directed to the authors who contributed to this paper.

Working Group Name:

Technological Innovations in Response to COVID-19

Working Group Description:

In response to the novel coronavirus (COVID-19) pandemic, states and localities in the United States issued stay-at-home orders and suggested social distancing measures. These widespread, unprecedented orders forced a large majority of nearly 330 million Americans to rely on technology to continue work, schooling, and other crucial societal functions. This Working Group is dedicated to reviewing the innovative uses of current technology and novel technology developed during the pandemic for response efforts and use by the public in daily life.

Priority Research Topics and Specific Research Questions:

Technology is a broad and vague term. Examples of the types of technology explored by this Working Group include the use of drones to enforce social distancing, the use of mobile devices for coronavirus tracking, robotics in healthcare settings, and the utilization of video conferencing and virtual reality for class instruction in K-12 and higher education. The sudden near-ubiquitous use of technology also raises privacy and security concerns.

In this proposed research agenda for technological innovations that emerged in response to COVID-19, our Working Group explores use cases over multiple sectors, including: Emergency Response, Government Services, Healthcare, Employment, Education, and Lifestyle. Segmenting findings by sectors illustrates the central role of technology in COVID-19 response efforts. The research questions were designed based on the impacts of technological innovations in response to COVID-19 on each sector. The group's collective research questions were identified by considering the potential effects of technology on the domains of influence, and vice versa. Shown in the table below, the domains of influence have been identified as the individual, community, organizational, and societal levels. Additionally, several questions attend to specific technologies used or unused (labeled the techno-sublevel). The proposed research questions highlight the need for an interdisciplinary approach to gain a holistic understanding of the topic, as well as the importance of diverse perspectives as we move into COVID-19 pandemic recovery and mitigation phases. For each domain of influence, the research questions were separated into general questions for each level and specific privacy/security questions.

			Research Questions
Domains of Influence	Micro-level – Individual and Household	General	• Research Question 1: How do individual behaviors and needs change with regards to employment and education given the increasingly blurred lines of work, education, and home life? • Research Question 2: Given the increased household utility use, how are socially vulnerable populations competing in education, employment, healthcare, and access to COVID-19 messaging? • Research Question 3: How does access to communications and technology resources influence social vulnerability during COVID-19? • Research Question 4: What factors might encourage the use of contact tracing mobile applications among the least and the most vulnerable?
		Privacy and Security	• Research Question 5: What types of privacy and security concerns for virtual healthcare services should be addressed to better serve the needs of patients? • Research Question 6: How does the shift from in-person to digital interactions increase vulnerability to corporate and state surveillance, and increase critical dependency on corporate technological infrastructure?
	Meso-level – Interpersonal/ Community	General	• Research Question 1: What are individual perceptions of employment tracking technologies used due to mass work-from-home initiatives? How do they impact productivity? • Research Question 2: How can we ensure COVID-19 related contents delivered through websites are accurate, unbiased, and perceived as trustworthy to the public? • Research Question 3: Given the increased use of video conferencing platforms in education and employment, what are the best use cases, including frequency of use and accessibility, to examine their impact on engagement and learning outcomes? • Research Question 4: In the U.S., how useful have new healthcare technologies been in the detection of COVID-19 cases? • Research Question 5: How might non-adopters in the use of technology become more vulnerable in the era of COVID-19? • Research Question 6: How do the changes in technology use and behavior impact the resilience of communities to disasters?
		Privacy and Security	• Research Question 7: What data or personally identifying information are employers collecting while their employees work remotely? • Research Question 8: What can be inferred from the tracking data about an employee's personal life?

	Exo-level – Organizational Governmental Laws Economic Political	General	• Research Question 1: When artificial intelligence algorithms create databases of coronavirus research literature, how can the comprehensiveness and accuracy of the contents be assured? • Research Question 2: What is the impact of the adoption of new and existing healthcare technologies (e.g., medical chatbots, telehealth) on service utilization, and health-related behaviors? • Research Question 3: How does the recent adoption of new technologies impact organizational behavior and culture? How does the increased use of video conferencing impact organizational behavior and culture? • Research Question 4: How can hospitals, government, and private companies collectively and effectively address the health needs of populations-at-risk with the current technologies and medical delivery methods? • Research Question 5: How has the use of technology (combined with social distancing) impacted local physical stores and small businesses?
		Privacy and Security	• Research Question 6: What data policies, including storage, access, sharing, and use of employee data collected, have organizations implemented to protect personal privacy and security? • Research Question 7: Are companies informing employers about employee tracking technologies? How transparent are they about the capabilities of these technologies? • Research Question 8: What are 'companies' perceptions of the security risk of a remote workforce and what steps are they taking to protect business assets and personal data?
	Techno-sub-level – Technology type	General	• Research Question 1: To what extent, and under what circumstances should technology solutions implemented during the pandemic replace standard practices in healthcare, education, government, and employment? • Research Question 2: What are the best practices for the interoperability of multiple technologies across each sector (education, government, employment, health, lifestyles)?
		Privacy and Security	• Research Question 3: In what ways has our near-ubiquitous use of technology in response to COVID-19 made us more vulnerable to cyber-attacks? • Research Question 4: What can we expect for security, privacy, access, and reliability of technologies in daily life?
	Macro-level – Societal/Cultural Norms and Values	General	• Research Question 1: How will COVID-19 have a lasting impact on lifestyle? What can we expect? Will things go back to normal (or a new normal)? • Research Question 2: How has COVID-19 demonstrated the need for countries and international institutions to address digital and systematic gaps?

			• Research Question 3: How will response to COVID-19 and the technological innovations adopted help us prepare for future disasters? • Research Question 4: What is the adoption rate of pandemic technologies, and what types of technologies do employers find necessary for business continuity? • Research Question 5: To what extent will employers and government keep using the technologies adopted during the pandemic once the pandemic subsides? • Research Question 6: How might the use of such technology facilitate or hinder biases against marginalized populations? • Research Question 7: What are the best practices for policy development and implementation to keep up with the progression of technology at such a rapid pace? • Research Question 8: What efforts are in place to reduce inequities (digital divide) in the receipt of government services due to a lack of wi-fi, software, or specific technological devices?
		Privacy and Security	• Research Question 1: In what ways has the robust use of certain technologies (e.g., video conferencing software) changed the culture regarding public preparedness for potential nefarious cyber activity? • Research Question 2: What can be learned from the human-computer interaction of our near-ubiquitous use of technology for almost every function in life (education, employment, health, government, lifestyle)?

Ethical / Methodological Considerations:

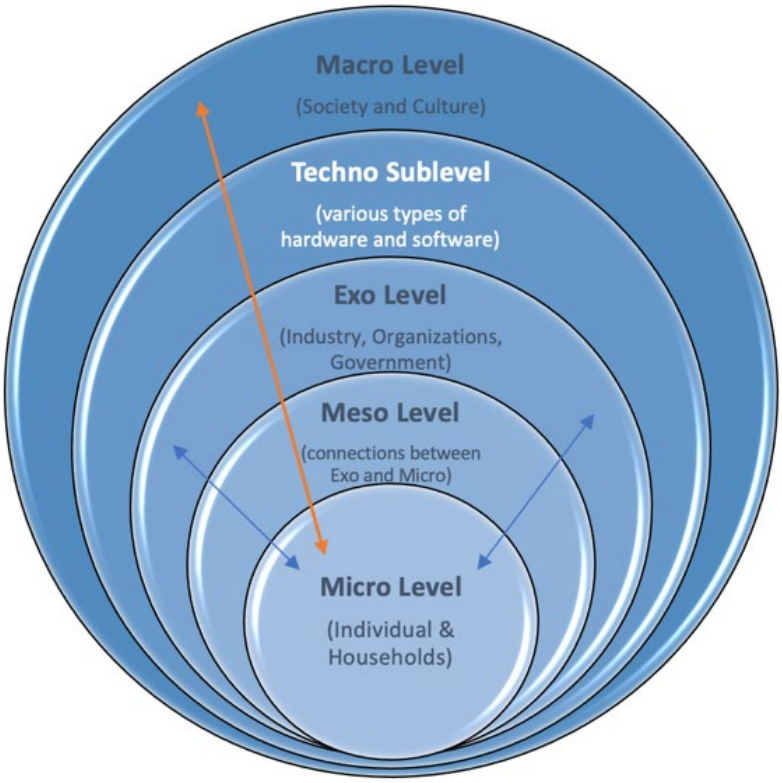
The typical methods used for qualitative, quantitative, and mixed methods research may not lend well to these studies as people socially distance. Qualitative research performed via video conferencing software may not provide the full picture (especially with regards to participatory research or with some ethnographic studies). Quantitatively, surveys disseminated online are biased towards individuals with access to the Internet and appropriate devices. Similarly, experimental designs performed with or on technological platforms are often biased towards those more technical savvy. In addition to IRB approval, other approvals from the national, regional, and local regulatory bodies might be required. Other special considerations might be required with regards to privacy, respect, and equality of human subjects involved in the research.

The broader ethical consideration is digital equity, as an individual should not be unduly barred from access to technology-mediated government, community, health, employment, and educational services based on factors outside of their control such as disability status, age, race, gender, sexual orientation, nationality, and so on. As such, in the development and implementation of technology innovations in response to COVID-19, there is an ethical imperative to study how these varying technologies may inadvertently exclude certain

populations at a time when access is integral to the individual, organizational, community, and societal well-being.

Working Group Frameworks and Points of Consideration:

The Bronfenbrenner framework encapsulates the majority of the questions proposed and was used to organize the table presented above. Initially used to explain human development, Bronfenbrenner's Bioecological Theory suggests that development occurs as a result of the direct interaction between the individual and their surroundings.



In short, individuals shape and are shaped by their environments. The bioecological model is used here to explore the changes that occur as a result of the interactions between technology and our environments, and the technological environments and ourselves given the near-ubiquitous use in response to COVID-19. Changes at the individual or microsystem are impacted by our communities (mesosystem) and the laws and policies developed (exosystem) by the industry. The meso- and exo-systems are also influenced by individuals. The macrosystem considers society and culture, which often adjusts at a glacial pace but may experience jolts due to historical influences. The techno subsystem, often thought of as an influence on the microsystem, is seen during COVID-19 to impact all systems. The model depicted anticipates this possibility and was used to frame the proposed agenda.

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