Leveraging online social networks for people with disabilities in emergency communications and recovery

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Abstract: Information and Communication Technologies (ICTs) can play an important role in leveraging social networks for emergency communications and recovery involving persons with disabilities, provided that proper consideration is given to the strengths and weaknesses of the distributed nature of online resources in relation to the instrumental, psychological and social needs of persons with disabilities in the context of disasters or other emergency events. Emergency and disaster events inherently involve uncertainty and dynamic risk factors, and pose design and implementation challenges for inclusive planning and delivery systems. The involvement of persons with disabilities as key stakeholders throughout the developmental and evaluation process is critical to the effectiveness of online social networks in bridging real-world concerns with virtual resources. An analytical model for understanding the role of distributed networks in mediating the negative impacts of a disaster or an emergency on persons with disabilities is proposed, together with key objectives for change.

Keywords: online social networks; disabilities; emergency communications; inclusive emergency planning.

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1 Introduction

Since the devastation wrought by Hurricanes Katrina and Rita, national consciousness of the need for disaster and emergency preparedness for people with disabilities has greatly increased. The immediate aftermaths of these disasters were occasioned by inadequate access to medical equipment, medicines, accessible communication media, assistive technologies, personal assistance, and even shelter (Waterstone and Stein, 2006). In addition to natural disasters, other types of emergencies and hazard events such as man-made or technological disasters pose physical, material and psychological strains on vulnerable populations (Edwards, 1998) and require effective communication networks and infrastructure to mitigate disruption to social environments (Dutta-Bergman, 2004; Shankar, 2008).

In December 2004, the Department of Homeland Security's National ('all hazard') Response Plan failed to mention people with disabilities (Waterstone and Stein, 2006). This occurred despite the prior enactment of an Executive Order by President Bush in July 2004, mandating the participation of administrative agencies in disaster response aimed at ensuring the safety and security of persons with disabilities (Waterstone and Stein, 2006). In July of the following year discussions were held by the federal Interagency Coordinating Council (ICC) on challenges relevant to disaster response for persons with disabilities (Waterstone and Stein, 2006). In 2006, and again in 2008, the US Department of Justice issued the 'ADA Guide for Local Governments: Making Community Emergency Preparedness and Response Program Accessible to People with Disabilities', which lay out a series of action steps for planning, notification, evacuation, sheltering and returning home (DOJ, 2009). One of the primary lessons drawn from Katrina is the importance of human and technology networks that are both fluid and robust for the dissemination of information and the coordination of resources (Shankar, 2008). The degree to which people with disabilities have adopted advanced communication technology, apart from television has been brought into question by one post-Katrina study (Spence *et al.*, 2007) although other authors, while not dismissing connectivity and interactivity factors for disadvantaged populations, point to self-organising online or advanced communication responses to Katrina outside the traditional emergency management structure (Laituri and Kodrich, 2008).

Interestingly, apart from radio and television, the ADA Guide for local governments makes no mention of many recent communication technologies (ICT); absent are computer-mediated linkages, web-based applications and multi-purpose PDA devices. These ICT represent an unexplored domain for increasing the 'bandwidth' of emergency communications, particularly when linked with online social networks, although a recent proposed National Council on Disability project focuses on the role of new

media and technologies to increase social participation by people with disabilities. Emergency communications convey information that serves as an instrumental support to persons with disabilities, containing messages and facilitating decision making and action, and online social networks can also support disaster and hazard preparation while enhancing both emergency comprehension and response readiness for persons with disabilities properly managed, the collective resources of an online social network, together with the supports embedded in its relational bonds can augment the effectiveness of emergency communications.

In fact, ICT broadly, and more specifically, wireless and mobile technologies have played an important role in disaster recovery in the past half decade; particularly when they serve to coordinate the efforts of grassroots volunteers, certain community organisations and community wireless efforts (Shankar, 2008). People with disabilities have increasingly turned to ICT for information, services, consultation and participation (Bricout *et al.*, 2010; Stienstra and Troschuk, 2005). Research finding from several countries detailing how internet and/or web applications as diverse as e-mail and web-based conferencing can be made accessible for people with disabilities point to ICT as a platform for information dissemination and exchange, as well as for building social networks (Myhill, 2002; Lathouwers *et al.*, 2009; Sevilla *et al.*, 2007; Sohlberg *et al.*, 2005).

There are, however, continued disparities in ICT use between disabled and non-disabled populations, due to accessibility and financial barriers. The adoption of cell phones, by people with disabilities has been generally more modest (with the potential exception of the use of cell phones for texting by the deaf) than for the general population, due to inaccessible interface features such as keyboards and voice activation features (Bryen *et al.*, 2007), as well as cost barriers. Despite a growth rate of internet use twice that of the general population, people with disabilities trail their non-disabled peers; for adults with disabilities, 38% compared to 55%, with home internet use differentials still more striking with 7% compared to 26% for the general population at the beginning of this decade (Hendershot, 2001).

These broad differences between disabled and non-disabled populations in internet access and use belie within group differences based on demographic, as well as disability-type variation; for instance, the US Census Bureau Current Population Survey Supplement in 2003 found the lowest percentage of internet use by older adults over 65 years of age with multiple disabilities (8.3%), with 5.9% living in a broadband household, compared to 72.1% of employed persons, in the 25–60 year old age bracket who are deaf or have a severe hearing impairment being internet users of whom 25.6% lived in a broadband household (NTIA, 2004). The type and severity of impairment, together with employment status, income and adaptive technology costs figure into within group variations in ICT use by people with disabilities, although not in a uniform fashion; for example, persons who have trouble leaving the home and are blind may find ICT access problematic due to lags in adaptive technology, while persons who have a significant neurological or physical disability may find the cost of adaptive prohibitive (Dobransky and Hargittai, 2006).

1.1 Emergency communication management

In emergency situations, such as disasters, the success of communication systems is based on the quality of knowledge-gathering and the effectiveness of the technology (Kapucu, 2005). Such communication systems are inclusive of broadcast alerts, general emergency and disaster preparedness information, and community-based dialoguing, problem-solving, knowledge, and instrumental aid.

For information to be useful to emergency management decision makers it must be clear, cogent, comprehensive and delivered in a timely fashion (Kapucu *et al.*, 2008). With regards to implementation, a translation process must be developed that interprets the critical information and breaks it down into actionable steps (Kapucu *et al.*, 2008). Participants in the communication process also derive a collective meaning through consensus building, facilitated by 'loosely coupled' social networks in which sub groups are relatively independent of each other (Kapucu *et al.*, 2008). Characterised by high levels of uncertainty and disruption of existing communication structures, emergencies require compressed information collection, processing, decision making and dissemination efforts (Kapucu *et al.*, 2008).

People with disabilities are a heterogeneous group with varying cognitive, communication, social, sensory and emotional capacities for understanding, integrating and using compressed emergency communications in a context of uncertainty. Emergency information management can be responsive to people with disabilities, therefore, by attending to the particular information literacy challenges of each of these constituencies, much as they would to other community groups such as non-English speakers, older adults and racial/ethnic minorities. Information Literacy (IL) entails the effective identification and use of relevant information supported by critical information search and assessment capabilities (Williamson and Asia, 2009). In other words, IL speaks to the information receiver's capacity for engaging information in a useful and effective fashion. The other side of the communication 'equation' is the sender's ability to generate and disseminate information that is comprehensible and actionable by the receivers. One way to address the implicit challenges to information processing and diffusion for people with disabilities is to leverage technology, in particular, ICT. Actionable knowledge and effective action in such situations hinges in large part on high-trust reciprocal social relations and a strong community of local, on-the-ground volunteers (Kapucu, 2005; Shankar, 2008). Communities can provide a suitable relationship-based trust network.

1.2 Community building

Emergency communications reconceptualised within a social networking context, serves as a channel, or channels, for communication responsive to the disaster or hazard event as well as providing a platform for an emergent community of responders and victims, and facilitating the maintenance of the ties of pre-emergency community. At a local level, emergency communications are embedded in community, and community in turn is embedded in the emergency communication network and infrastructure. Communities provide the foundation for emergency preparedness and planning. Advance planning for information sharing will greatly improve disaster response and must cut across sectors: public, private and non-profit (Kapucu, 2006). During the hazard or disaster event and its sequelae face-to-face information is very important (Dutta-Bergman, 2004), but it

is precisely at such times that familiar, local social networks may break down or be inaccessible as the individual with a disability is either unable to evacuate, or if evacuated, removed from his or her habitual community. The flow of vital information is thereby truncated, reflecting the dislocation of community networks. Part of the work of the social network is to restore community, about which more will be said later. In this context, network and community are largely synonymous. Indeed, communities are a special case of social networks bounded by identification with a place, group or interest and a sense of belonging.

Informal community information flow, instrumental assistance and support, whether generated face-to-face or virtually in an online environment is what we anticipate facilitating with emergency related social networks. This dynamic community structure could then be extrapolated further to a larger region. For example, social networks could serve as a medium through which individuals that are within Community A could gain valuable information from nearby Community B because of the online network. Community A might not be as large or as sensitive to the needs of that particular disability as Community B. In other words, an expanded version of community, whether regional or beyond opens up non-linear information sharing and knowledge building as novel information is shared across networks. Emergent knowledge is developed at the intersection of different networks and their environments. It is important to identify hubs for online networks, such as existing online community or social networking sites; initially serving as building blocks, and subsequently as bridges across affected areas.

One venue, or locus for community infrastructure maintenance is found in Community Technology Centers (CTCs), whose chief aims are to provide both access and computer literacy skills to the public; particularly for groups less likely to evidence them, such as rural and inner city residents, older adults, ethnic and racial minorities and individuals with lower income and education levels (Kvasny, 2006). Due to the variation in CTC organisational goals, governance, programme content, funding, and resources it is not possible to arrive at generalised statements about their impact on access and computer literacy although they are a model that has garnered significant public funding in the USA (Kvasny, 2006). Nonetheless, CTCs have the potential to provide not only technical, but also more importantly, training and education services for community preparedness (Shankar, 2008). The efficacy of emergency communications hinges in part on the prioritisation of information and directives by trained personnel (Glik, 2007). High levels of stress and arousal may impede the recipients of emergency communication from internalising and acting upon vital information but this effect can be mediated by creating receptive mental models through knowledge networks in advance (Glik, 2007). CTC could host training and education sessions, either face-to-face or online, that would facilitate the development of mental models receptive to emergency communication, as well as information and/or knowledge useful to emergency situations. A key factor in CTC success appears to be embedding them in community interpersonal networks (Hayden and Ball-Rokeach, 2007).

Community-embedded CTCs appear to benefit from high levels of trust and draw participants through word-of-mouth (Hayden and Ball-Rokeach, 2007). It is reasonable to suppose that CTC effectiveness in computer literacy training and ICT participation will hinge in part on community buy-in, or more fundamentally, adaptation to community needs and aspirations. Suitable 'community' embedded CTCs for people with disabilities could be achieved through engaging larger groups (*i.e.*, racial/ethnic or geographic

communities) or through disability-focused groups, but it is clear that for CTCs to be effective for persons with disabilities they must be 'accommodating' or better still 'adaptive' in the broadest sense. It has been proposed that CTCs generally could increase compliance with emergency communication warning messages and directions through pre-event education that removes barriers to action around message sequencing steps, meaning, urgency or legitimacy (*i.e.*, Glik, 2007). Online social networks of people with disabilities could use CTC as accessible interface sites; moreover, a dialogue between CTCs and online social networks could improve the information carrying capacity for both entities in emergency communications and during recovery. Message consistency, accuracy, information sufficiency, homophily and credibility, essential aspects of effective emergency communications (Glik, 2007) can be supported through the coordination of 'adaptive' CTC and online social networks of people with disabilities.

The community wireless movement has, if anything increased the urgency of CTCs serving as a nexus and mobilising agent for loosely coordinated volunteers (Shankar, 2008). Community building has also been fostered using CTCs, informed by surveys of community assets, including social network and social capital surveys (Ashton and Thorns, 2007; Hayden and Ball-Rokeach, 2007; Pinkett and O'Bryant, 2003). CTC can also mobilise online access, as well as offline relationships and supports (Foth, 2006; Williams, 2006). Online community preparedness and effective emergency communications depend on having a community in place, thus the foundation of social networks for disaster planning and recovery is laid in advance. For people with disabilities, for whom internet accessibility and web-based application accessibility may be problematic (Baker *et al.*, 2006), community building that straddles online and offline environments is a precondition for effective emergency communications online planning, response. Thus, CTCs that leverage their community ties have a pivotal role to play in emergency communications, planning and recovery for people with disabilities. Centers for Independent Living (CILs) are good candidates for taking on the CTC role, chiefly because they are disability focused by their charter and function.

CILs are a key network of non-governmental advocacy organisations for people with disabilities. CILs are multipurpose cross-disability advocacy, self-help, information, and service centres across the country dedicated to independent living for persons with significant disabilities (Fox and Kim, 2004; Ravesloot *et al.*, 2007). Like all citizens, people with disabilities rely upon a coordinated disaster response and recovery system, but one that is prepared in particular for disability-related evacuation, accommodation and relocation needs. For people with disabilities CIL and Statewide Independent Living Councils (SILCs) databases can provide emergency personnel with information critical to disaster response, including medication and assistive equipment needs (Rowland *et al.*, 2007). Similarly, in their roles as both CTC and non-profit sector agencies, CILs can play an important role in the coordination of communication as well as information. In addition to fixed location sites such as CTCs and CILS, Community Response Grids (CRGs) using the internet and mobile communication devices can facilitate the coordination of community member and emergency management networks (Jaeger *et al.*, 2007).

The CRGs can take on a parallel function to the online social networks, building social capital and trust, while linking recovery and response efforts to e-government resources (Jaeger *et al.*, 2007). Public policy initiatives that identify CRGs and CTC as potential nodes for disaster planning and recovery would advance the development of effective online social networks for communication, information gathering and

dissemination, social and economic exchanges. The deprivations and dislocations occasioned by disaster will alter the nature of online social networks and the virtual communities. Policy is a key part of emergency planning and recovery for that reason. It can help shape the design of mechanisms and procedures for community retrieval; that is the renewal of communal practices through online exchanges and projects that build a sense of shared identity (Ashton and Thorns, 2007). In the context of disaster this implies a new identity forged, at least in part, from the experience of disaster itself. That disaster or hazard event can, under some conditions, generate trust and social capital, particularly when employing online social networks. The need to address the negative effects of emergencies on the well-being of people with disabilities is paramount, although ICT can either provide or facilitate tangible instrumental support. A closer examination of the role of social networks in the context of emergency will show how interpersonal networks using online platforms can provide instrumental, as well as social, emotional and psychological support.

1.3 Social networks

The economic, psychological and material impacts of emergencies and disasters are perhaps more evident than the social impacts, but emergencies can nonetheless be framed in social terms, as evidenced by the social infrastructure impacts, including social disruption, dislocation with profound organisational, resource and relational implications (Varda *et al.*, 2009). A focus on the community level implies the sociocentric level of social network analysis, emphasising the network member relations, the nature and probability of ties as relates to the larger social structure, rather than an egocentric focus on the characteristics of network members linked to a key individual (Varda *et al.*, 2009). Relationships have an important role to play for persons with disabilities in disaster situations and relationships developed over time are more likely to provide the resources for effective responses (Spence *et al.*, 2007).

Online social networks tend to generate the types of relationships that are associated with action, including collective action and mobilisation (Kavanaugh *et al.*, 2005). According to social network theory a key characteristic of relationships is the strength of the tie. Online social networks are better adapted to generating weak ties, which enable individuals to connect to others outside their habitual social circles, which in disaster circumstances has the benefit of providing intact networks undisturbed by the attendant disruption and dislocation. Internet social exchanges may also be effective in fostering face-to-face interactions and offline relationships; the offline relationship building potential of online social networks raises the possibility of new particular friendships and primary social group building, or the generation of bonding social capital and strong ties, which are also important to community building and facilitate instrumental aid (Kavanaugh *et al.*, 2005; Kilpatrick *et al.*, 2003; Xie, 2008). The combination of bonding and bridging social capital facilitates both community building and effective emergency communications (Kapucu, 2005).

Thus, online social networks have the potential to restore community, and in so doing render emergency communications more effective, as well as mobilising collective action. This leads to better compliance in the short term, and reparative responses to the dislocations and disruptions in the medium term. Meanwhile, ICT-based informational and service networks can ensure continuity of services beginning with the activation of emergency communications.

2 Analytical model

We argue that distributed social networks, online (and otherwise) networks:

- can augment development of disability-friendly emergency communications, as well as the capacity of people with disabilities to interpret and use emergency communication information
- providing a vital resource for restoring normalcy and community post-emergency.

Emergency communications targeting people with disabilities must meet a 'usability' criterion which integrates end-user (disabled person's) needs and preferences in the design phase and exceeds 'generic' accessibility design components (Roberts and Fels, 2006). The principles of usability in the ICT context prioritise user-specific goals, as compared to accessibility, which emphasises adaptations suitable for a wide array of users with different disabilities and competencies (Jaeger, 2006). Greater accessibility in terms of access to information can, paradoxically, render understanding more difficult by expanding cognitive loads if the user's capacity is not figured in (Bunning *et al.*, 2009); again pointing in the direction of usability design features and principles in ICT. Aside from the 'broadcast' or alerting function of online social networks, a second, participatory function is that the networks can provide a platform for emergency communication managers to solicit information for designing 'usable' emergency communications as well as test out usability designs prior to use.

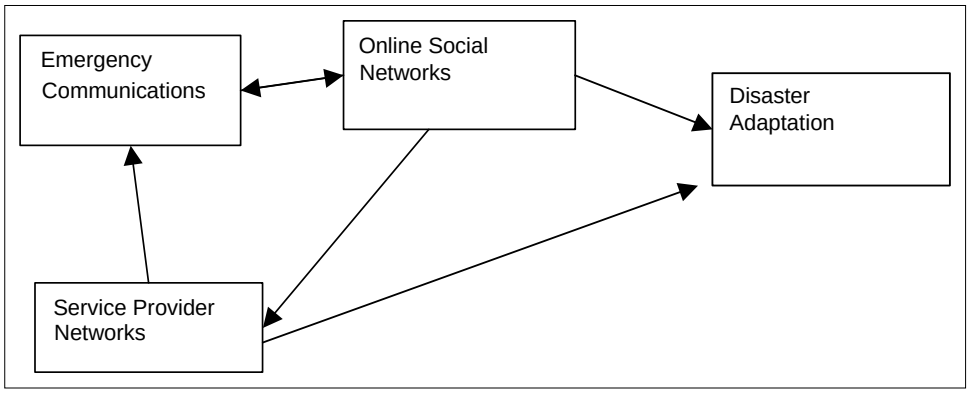
Once emergency communications are initiated, informal community social networks have typically provide resources for interpreting information, sustaining social supports otherwise unavailable in a crisis situation and providing a broader context for making decisions about, for example, when to commence evacuation. Even if the information is not entirely accurate or current, local specific information may have heightened value for critical populations. In this case the perfect may be the enemy of the good. Previous studies suggest that persons with disabilities are more concerned with immediate matters than with 'big picture' issues affecting distant places (Chappell *et al.*, 2007). However, information about the broader context that is embedded in relational networks of other people with disabilities has an immediacy and relevance that transcends geography and has personal utility for individual coping and decision making. The research literature is silent on the impact of social networks on the interpretation of emergency information; in other words, whether online social networks might either distort or clarify such information. This suggests an important agenda to pursue, either in terms of stakeholder surveys or in experimental pilot tests.

Certainly, the communication competence of the parties involved will have an impact on information accuracy and people with disabilities; the social aspects of communication may impede information exchange (Homes, 2003). It stands to reason, however, that online social networks with which emergency managers have interacted in collaboration for emergency preparedness will develop a kind of 'community competence' at interpreting emergency communications. In service of developing those relationships emergency managers may wish to develop relationships with CILs and other CTC that serve persons with disabilities as a spring board to both locating relevant websites as well as face-to-face contacts. The restoration of community and normalcy are actually closely intertwined inasmuch as individuals can draw meaning and identity from community membership (Kilpatrick *et al.*, 2003). Online social networks can provide

critical information, instrumental assistance, psychological and emotional support for the reestablishment of life in community. Again, embedded online social networks with strong connections to emergency management are critical to renewal.

A systems model of emergency communication in the context of hazard events or disasters is proposed that illustrates the relationship of online social networks to the impact of emergency communications on people with disabilities and their communities. Online social networks occupy a central position, mediating the effects of the emergency communications and service providers on adaptation to disaster.

Figure 1 Systems model of adaptation to disaster



Successful planning and implementation of social networks suitable for enhancing emergency communication 'bandwidth' before, during and after emergencies requires attention to key practical and policy considerations around responding to and remediating the disruptions that are endemic to hazard events and disasters.

3 Programmatic and policy response: development of Civic Emergency Social Networks (CESN) (pronounced see-son)

Given that we have established the rationale and desirability of the development and deployment of online social networking to facilitate civic emergency communications, what are the appropriate mechanisms for bringing these into being? There is sufficient literature on the operation of social networking, and even online social networks in general, but it would be useful to run user tests on the operation and best practices to understand the potential barriers and failure point of these systems in the context of emergency communications involving people with disabilities. As is the case typically of these sorts of systems, the time to design, deploy and test them is well in advance of the need for them. Preparedness in this context begins with cross sector partnerships aimed at coordinating existing online resources, including relevant blogs, government websites, social networking platforms such as Facebook and MySpace, and disability advocacy organisation websites in 'emergency exercises', targeting local user communities.

Such exercises, apart from testing the robustness of coordinated activities should also focus on assessing the adequacy of existing online social networks in terms of interactivity, connectivity, user responsiveness and information immediacy (*i.e.*, Paul, 2001). The evaluation of sociometric level properties of the networks for facilitating resource and relational linkages robust to both temporary disruptions and longer-term dislocations is also critical (*i.e.*, Varda *et al.*, 2009). Where online social networks are found to have structural or process weaknesses consortia of local, state and federal government agencies, government advisory bodies (such as disability boards), non-profits and citizens with a disability must devote shared resources to shore up the infrastructure. Policy plays a critical role in the formative efforts of these actors by through a variety of instruments such as:

- outreach and awareness campaigns (to increase the visibility of the social aspect of effective emergency communications)
- implementation directive (pilot projects to demonstrate the efficacy of distributive networks of the type made possible through online social networks for cost-effective responses that also build a foundation for longer-term recovery)
- empirical based policy research (rational and objective policy decisions and approaches driven by a programme of empirical research and objective test beds).

There the development of online social networks for emergency communications involving people with disabilities can be thought of as having six fundamental components:

1 civic participation

2 model systems

3 target audiences

4 objectives

5 evidenced based approaches

6 policy challenges and barriers.

Each of these will be discussed in turn.

3.1 Target audiences

People with disabilities constitute a heterogeneous population, sometimes described as multiple accessibility audiences in the online domain (Anderson *et al.*, 2004). For this reason, it is critical to involve users from this key stakeholder group in the development of the infrastructure and interfaces for online social networks, as well as the content and focus (Anderson *et al.*, 2004). Categorical approaches to web accessibility often are tailored to the individual needs in the face of individual variation, developmental changes in functioning, comorbidities, and differences in the severity and scope of disability (Anderson *et al.*, 2004). This approach, arising from an 'assistive technology' frame of reference, might actually be better served by adoption of universally design principles which focus on reducing general barriers (changing the context) rather than 'adapting the individual'. The drive towards web accessibility is often characterised in terms of 'design

for all' (Brophy and Craven, 2007) and has been propelled in the USA by Section 508 legislation, which requires accessible electronic and information technologies, and internationally by the World Wide Web Consortium (W3C), based on normative, accessibility rights-based arguments that resulted in the Web Content Accessibility Guidelines (WCAG) 1.0, and more recently with the development of WCAG version 2.0 (Brophy and Craven, 2007; Brys and Vanderbauwhede, 2006). The specifics of accommodations for different disability groups and audiences is beyond the scope of this paper, however, it is clear that with regards to emergency communications, accessibility of the information is critical. Such accessibility also requires attention to the information technological literacy of the user and to relation-building with the user, which is a growing concern for e-government, as it seeks to increase trust, interactivity and responsiveness in a form that accommodates individual citizen's interests (Pan *et al.*, 2006). The same principles hold true for emergency communications, whether originating from public, profit or non-profit entities. These principles require concrete objectives for action.

3.2 Objectives

There are three key objectives that must be met for the successful deployment of emergency communications in an online social network matrix:

1 the development of coordinated online social networks that functionally serve the purpose of 'community' online and impact real-world, offline community functioning. This requires that existing online social networks, both institutionally-based and 'spontaneous/self-organising, be leveraged using the disaster/hazard event-dedicated resources of the relevant emergency service providers, public, private and non-profit entities, including CILS, CTC and CRGs

2 development of sufficient wireless, web-based and computer-mediated infrastructure to sustain online social networks in emergency communications and in tandem with such communication networks

3 using emergency trainings and simulations as test beds for linked online social networks and emergency communication packages and strategies. The test bed objective points to the importance of developing evidence-based approaches.

4 Conclusion

New dimensions to emergency communications are opened up when disability-related considerations are factored into the design and implementation of such communications in the context of hazard events or disasters. For emergency communications to engender not only compliance but also mobilisation and effective responses they must be embedded in online social networks that function as distributed communities of persons with disabilities, local, regional and beyond and link to providers and critical knowledge/information sources. The emergency communications become one channel for a broader, relational network that extends from the virtual/online realm into real-world resources and relationships. Online social networks marshal accessibility tools, e-government and web-based private, non-profit and public sector resources,

while also allowing the collection of aggregated data pertaining to every aspect of emergencies and their aftermath for the purpose of enhancing the effectiveness of future communications. At the heart of this process, community, as embodied in the online social networks, is reinforced and repaired, with emergency communications serving a critical dialogic function aimed at improved responsiveness, rather than a directive, single channel tool of a command-and-control approach to disasters and hazard events. Instead, an ecological approach is proposed, in which online social networks, providers and emergency communications are linked in reciprocal lines of influence, creating relationships that are robust in the face of the disruptions and dislocations that attend hazard events and disasters. This model can form the basis of testable practices leading towards evidence-based interventions and the formulation of multi-level policies coordinating local, state and national emergency communications.

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