

Mass Population Response to Major incidents and Critical National Infrastructure failure

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Abstract

For many years, the role of emergency services, government and even international humanitarian organisations have been very prominent. Government and all government agencies have played a major role in saving lives, preserving properties, prevented damage and breakdown of Critical National Infrastructure (CNI). However, the 9/11 incident, Asia Tsunami (2004), complex disaster in Japan (2011) and Christchurch earthquakes (2010, 2011) to mention a few, have proved that the capacity of CNI, emergency services or governmental agencies are insufficient in facilitating effective response to complex, major or unprecedented incidents. Perhaps this reality or continued CNI failure across the world have forced the general public to self-organise, draw from survival instinct or empathise with one another in the face of death. The paper examines how communities in Christchurch responded to sequence of major incidents and theoretical explanations of the nature of response that took place in two communities. Through review of existing literatures, reports and focus discussion sessions, the role of social infrastructures in enhancing mass population response to failed CNI during major incidents in these communities is captured and evaluated. Communities in Christchurch have shown that social infrastructures can integral to mass population response during major incidents. Beyond this, community action has become a melting point and the social fabric of communities in New Zealand in the quest to becoming more disaster resilient.

Keywords: Emergency Management, Response, Social Infrastructure, Disaster Resilience, Community

Introduction

The perception that Critical National Infrastructure (CNI) will be sufficient to support affected communities during the onset of disasters or major incidents have been gradually eroded over the years. While CNI as maintained by government is not strong enough to cope with the scale and magnitude of incidents as we now experience them, the impact of climate change, globalisation, urbanisation and different levels of response capabilities continue to push both government and people to seek means of surviving despite all odds. The inability to proffer ready-made solutions to these challenges has motivated compromises and restructuring of systems at different levels of government administration and resilience at community level to cope with disasters (Waugh and Streib 2006). According to Geis (2000) the history of “disaster resistant” or “disaster resilient” communities dates back to the early nineties, but more relevant with the current challenges experienced in emergency management and the devastating impacts of disasters.

New Zealand being a country prone to several hazards such as earthquakes, tsunamis, volcanic activities, landslips, drought, flooding to mention a few, the recovery of one incident is often the inception of another. Being a resilient nation is not just status, but an ongoing process for New Zealand since 2002 (Finnis 2004). Despite the commitment to building a resilient nation by supporting communities to be disaster resilience, the impact of hazard activities often temporarily affect or significantly affect critical infrastructure and essential community functions during major disasters (Becker et al 2011). Critical Infrastructures (CI) as used in this context refer to essential physical and organisational structures and facilities which enhance economy, safety, development and security of which their failure or shortage can result in severe consequences (Brit et al 2012). CI are, but not limited to energy supply, water and food supply, sanitation, insurance, technology and telecommunications, emergency services, government authorities and legal services.

While all these infrastructures are managed by different government authorities and agencies and efforts are in place to make them more efficient during and in the aftermath of any incident, they are often delayed, bureaucratic, problematic and less representative of community interests (Becker et al 2011). As a result, communities in Christchurch commenced facilitating systems, networks and organisations which can help them to better respond to major incident as well as be self-sufficient (Everingham 2014). Since 2005, Lyttelton in Christchurch have gradually built her self-sufficiency and economy exchange model called the “Timebank” which will prove vital to her safety, mitigate the impact of sequence of incidents as well as CNI failure. The elements of this “bottom-up” approach is now being replicated across Christchurch city post-earthquake and supported by the local authority

in order to enhance disaster resilience in communities, especially the ones prone to major incidents like Lyttelton.

Background to Social Infrastructures in Christchurch

The location of New Zealand makes the country prone to the impact of hazard activities. Although some locations are more prone to direct impacts of hazards than others, Lyttelton falls into the category of hazard-prone communities. Proneness to hazard activities does not infer weakness to coping with them since many communities have shown resilience in the event of severe incidents. Hence the word “vulnerability” is deliberately avoided by the civil defence to describe communities prone to disasters, as it suggest weakness. This notion has informed several researches to investigate and attempt to understand interactions, social networks and systems within resilient communities in New Zealand. Researches and reports by Hayward (2013), Ozanne (2010), Jefferies (2012) and Britt et al (2012) have identified social infrastructures as essential features of these communities especially during CNI failure and incidents which threaten their livelihoods. Social infrastructure as mentioned here refers to social connections, networks and the organisation of resources and services that build them in a community. According to Paton and Johnston (2006), resilience at community levels are created by established social infrastructures. In other words, strong social infrastructures create strong communities with good foundations for shared values, positive and economic trends. Thus, communities with limited social infrastructures are likely to be less capable of mobilising effective mass population response during emergency situations.

Lyttelton

Lyttelton is located 13 kilometres from Christchurch and accessed by a single road tunnel (Ozanne and Ozanne 2013). This means any disruption that forces the closure of the road tunnel literally cuts Lyttelton away from Christchurch and essential services and aid. The physical and tangible reality of this isolation contributed to the strong culture of self-sufficiency, community cohesion and community responsibility in Lyttelton (Everingham 2014). Lyttelton is built on a sloping terrain but boast of international seaport, trade and commercial centre with communities at Corsair Bay, Cass Bay and Rapaki which are all located on the lower slopes (Christchurch Council 2014). The 3,000 residents of Lyttelton has dwindled in figure since the earthquake sequence and the population is just less than 3000 as at 2013 (Christchurch council 2014). While some residents moved houses within the community, others relocated completely out of the area, but record has it that a few have moved back (Everingham 2014). Lyttelton maximises the benefits of the community

development/support organisations, recreation groups, community facilities and resident/business associations (Christchurch Council 2013). But the role of the Lyttelton Time Bank is more significant in supporting and sustaining all these social infrastructures and the community as a whole (Everingham 2014).

Social Infrastructure: Lyttelton Time Bank (TB)

The Lyttelton Time Bank was initiated in 2005 to foster the spirit of self-sufficiency in Lyttelton (Everingham 2014). Time bank is a coordinated as an alternative form of money exchange called community currency (Seyfang 2004; Ozanne & Ozanne 2013). According to Seyfang (2002), time banks are new forms of community currency based on non-reciprocal trading services or activities. Time banks or new currencies in form of economic exchange arise when there is little confidence in the economy or currency (Seyfang 2003). The TB model of exchange is operated on the understanding that every member and the labour they provide is equal in value regardless of the service provided (Ozanne and Ozanne 2013). Therefore any labour provided by TB member is measured in hours and rewarded in corresponding hours of credit time (Ozanne and Ozanne 2013).

Although lack of confidence in the New Zealand currency or economy was not responsible for the inception of time bank in Lyttelton, the TB was initiated to foster self-sufficiency and community interaction (Jefferies 2012). This initiative and interaction paid off in response to the 2011 earthquakes and subsequent incidents in Lyttelton. In the lead to major incidents in Lyttelton, the TB has indirectly helped to build a fused social network groups, develop, organise and sustain critical resources as well as a database of people with skills and local knowledge, capable of responding to basic needs. While Lyttelton were unaware how resourceful the TB will be in the event of any disaster or major incidents, or how it has helped to enhance their resilience in responding to earthquake in 2011 when CNI failed, Lyttelton has proved that communities are more resilient when they have vibrant social resources (Ozanne and Ozanne 2013).

Riccarton

Riccarton comprises of census area units namely, Riccarton, Upper Riccarton, Ilam, Avonhead Riccarton West, Mona Vale, Wharenui and Middleton (Christchurch Council 2014). Riccarton suburb is located in Riccarton/Wigram Ward, West of the city centre but separated by Hagley Park. Riccarton and Blenheim roads are two major arterial routes into the city and are busy retail zones (Christchurch Council 2014). The entire area boast of over 25,000 Population with a fusion of Europeans, Maoris, Pacific Island, Asians, Middle Eastern, Latin Americans, Africans and other ethnic groups (Christchurch Council 2014). Riccarton area has community organisations,

recreational/leisure groups, faith-based organisation, residents' groups and other social forums and organisations (Christchurch Council 2014).

University of Canterbury is also hosted in this census area unit as well as other education institutions. While many of these community facilities are supported by Christchurch city council, the proximity and presence of University of Canterbury (UC) proved crucial in responding to community needs in the area and in Christchurch as a whole. Besides have the Emergency Response Team at UC and a dedicated Emergency Operations Centre (EOC) who were strategic in facilitating response to September 2010 and February 2011 earthquake sequence, the role of a student movement born from a facebook page is also indelible in this history of Christchurch Earthquakes response (Lewis 2013).

Social Infrastructure: Student Volunteer Army (SVA)

The Student Volunteer Army (SVA) is an organisation facilitated by community action through youth engagement to respond to disasters and community service (SVA 2014). The organisation evolved from the massive "clean-up" need which arose from the impact of the September 2010 earthquakes in Christchurch. The facebook group promptly mobilised over 2500 volunteers to undertake the clean-up which was effective to the extent that the UC student Association President Kohan McNab formally created UC Student Volunteer Army (SVA); a student club focused on student volunteering (Law 2011). The structure and activities of SVA revolves around response to request for community service and ability to mobilise student volunteers who are able to use their wealth of skills to support affected community to path of recovery.

Mass Population Response to Christchurch Earthquake in 2011

The description and structure of both the Lyttelton Time Bank and Student Volunteer army provides a good background to their objectives, missions and modus operandi. Despite the role each play in mobilising response to the earthquakes sequence, the nature and logistics of response from Emergency Management (EM) perspectives cannot be compared on similar scales. The immediate onset of earthquake in Lyttelton was prompt, professional and based on several years of fused community interaction, wealth of resources and accountability. The coordinator of the Lyttelton TB was also the Civil Defence representative in Lyttelton, hence response within Lyttelton was organised based using existing knowledge of emergency management logistics and communication using local knowledge and networks provided by the TB.

During the February 2011 earthquakes, Lyttelton was cut-off from support from the city, as there was no form of communication from the Canterbury Civil Defence nor from the city at the immediate onset of the incident (Everingham 2012). The community also experienced loss of power, water and sewage and closure of the only tunnel road which links Lyttelton with Christchurch city as a result of this major incident. Regardless of CNI failure, Lyttelton mobilised a coordinated emergency management response maximising the TB resources and existing database of information (Jefferies 2012; Everingham 2014). The TB coordinators were familiar and trusted sources to provide information and were able to evacuate local residents to a safe location while information were provided to residents daily using the information centre and through the use of community notice board located outside the recreation centre (Ozanne and Ozanne 2013).

The TB was able to provide the basic resources and information needed through the existing database of 330 local TB members and indirectly through 18 organisations who were also TM members (Ozanne and Ozanne 2013). During this period the major role of social infrastructure in facilitating response in Lyttelton when CNI was disrupted due to the impact of the earthquake was notable. The importance of the TM during response to the earthquake has since encouraged more members to join the TM seeing the membership of TM increase progressively since the 2011 earthquake response (Everingham 2014). Beyond the earthquake sequence and due to its effectiveness in facilitating response during the period, the TM is considered as an essential EM tool which has since been used in response to series of flooding events in early 2014 (Everingham 2014). Although the TM is not without its limitation, its significance in enhancing disaster resilience in Lyttelton is widely recognised in Christchurch. Figure 1 shows the classification of networks and social infrastructures linked to the TB.

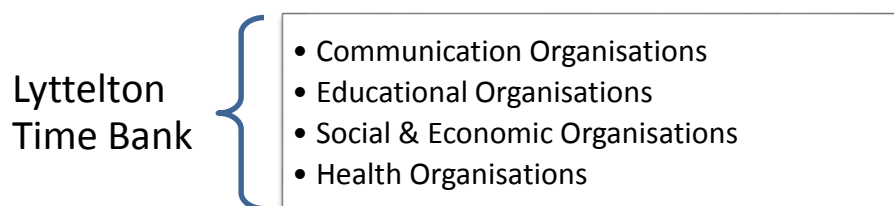


Figure 1. Classification of networks linked to Lyttelton Time Bank
(Adapted from Ozanne and Ozanne 2013)

On the contrary, within Christchurch city where there was access to basic emergency services, response was slow and witnessed by confusion at the initial stage. Perhaps this was because the CNI were also disrupted at the immediate onset of the incident, or the unprecedented nature of the

incident. However, CNI was gradually restored to areas which were not badly affected while worst hit areas were almost impossible to access by road. The success of the SVA in September 2010 encouraged the leadership to promptly mobilise young people who were confined to their homes because of the impact of the incident without power supply. The SVA teamed up with the UC student association team, Te Waipounamu foundation, White Elephant Trust and three other student clubs to mobilise about 13,000 students to volunteer weekly to help with clean-up, delivery of water and food in the worst affected areas of Christchurch using chartered buses (SVA 2014). In the aftermath of the 2011 earthquake, the SVA worked in partnership with the Civil Defence and city council to respond to individual assistance request they received via social media, the SVA website and texting (SVA 2014).

These series of response to individual assistance across the city continued for as long as SVA and her partners had capacity to do so. The current membership of SVA is over 1300 and the mission statement which is to “make service a part of the student lifestyle by inspiring and activating students to be the change in their community” has also been captured into an academic module called CHCH101 taught in UC via the school of educational studies and leadership. CHCH101 which is titled “Rebuilding Christchurch- An introduction to community engagement in tertiary studies” is a module which integrate a minimum of 30 hours of community service relating to Christchurch earthquakes with post-disaster response and volunteerism into students studies. While the module has effectively engaged and recorded sign-up from students from all over the world especially the United States, it continues to evolve based on community needs, post-earthquake era.

Discussion

Mass population or community response as reviewed in Christchurch to the 2011 earthquake has demonstrated the ability of communities to mobilise response during disaster and when CNI fails. It is the overarching responsibility of the government is to strengthen emergency response capabilities at all levels, while the primary responsibility of community is to mobilise capabilities which will support and complement government’s efforts. However, it seems the circumstances during response to the 2011 earthquakes in Christchurch saw these community-government responsibilities reversed.

Social Infrastructure Vs CNI in Mass Population Response

Emergency management (EM) in New Zealand is informed by the application of knowledge, measures and practices that are necessary or desirable for the safety of the public and properties

(CDEM 2006). EM is also designed to guard against, prevent, reduce or overcome any hazard or harm or loss that may be associated with any emergency (CDEM Act 2002). This connotes that the Civil Defence strongly strive for development and application of comprehensive emergency management by addressing risks through reduction, readiness, response and recovery (4Rs) to achieve a resilient country. According to WREMO (2012), emergency practitioners in New Zealand seek to develop robust and sustainable response capacity while consolidating readiness arrangements for and in communities prone to disasters.

Unfortunately, the nature and dynamics of response to the Christchurch earthquakes did not quite reflect a comprehensive or robust response capacity. While the nature of response is sparsely researched into from a core EM perspective, researches, reports and literatures such as Becker et al (2011), Britt et al (2012), Hayward (2013) to mention a few, have focused more on resilience frameworks and well-being in Christchurch mostly on the recovery process. Researches written on the Christchurch earthquakes have also focused on community interaction, community resilience and resilience frameworks which explains how Christchurch coped with the earthquake sequence. While these researches and reports have helped to explain level of resilience in Christchurch, Britt et al (2012) examined resilience in such a way that their work has indirectly emphasised the need to further evaluate response in Christchurch. Of which the importance of understanding, improving and optimising mass population response integrated with EM response arrangements lies in this research.

Disaster and emergency situations epitomise the nonlinearity of human events, which means the inherent nonlinearity of these situations make them particularly challenging (Kiel 1994). Hence the need to critically evaluate the merits or/and demerits of promoting the role of Social infrastructures over the significance of CNI in facilitating the networks of social infrastructures during mass population response to major incident as experienced in Christchurch. The more advanced school of thoughts in emergency response recognises confusion, disorder and instability of spontaneous act of kindness which might be inspirational to many, but difficult to replicate or implement within different scenario and with community actors. Thus, on what rationale, models, theoretical approach and explanations do we base the nature of response in Lyttelton and Riccarton on? As an in-depth understanding of this will ensure that appropriate lessons are learnt from challenges, limitations and best practice of the mass population response to CNI failure and incidents in view of preparing for future crisis.

According to Dillon et al (2009) emergency response can be divided into two distinct phases which comprises of the "Golden Hour" or the 'Emergency' phase and the 'Recovery' phase (p.92 - 93). The

emergency phase is led and coordinated by the emergency agencies namely, the police, fire, ambulance in collaboration with the local authority when there is immediate threat to public safety, personal safety and damage to the environment and property (Dillon et al 2009). It can also be implied that initial response as specified during the 'Emergency' phase can also covers response when there is threat to CNI.

This explanation of response phases provides a global understanding of EM response regardless of the terminologies used to describe roles, structures and EM agencies obligated by law to coordinate these phases. For example in the United Kingdom (UK), the emergency services or agencies which are responsible for 'Emergency' phase response are called 'Category 1' responders and their specific duties and transfer of duty arrangement to other agencies are outlined in the Civil Contingency Act 2004. The emergency response 'Recovery' phase is the response to help return to some degree of normalcy, the period which follows 'Emergency' phase; a period characterised by consolidation, investigation, remediation and recovery (Dillon et al 2009). This background to EM response as operationalized globally clarify the distinction between both response phases of EM during any incident.

Mass population response to the February 2011 earthquake in Lyttelton was carried out at the 'Emergency' phase when there was threat to safety at all levels. In addition to this, all CNI were disrupted and non-functional as Lyttelton was literally cut-off from any governmental support from Christchurch, with no communication or access of roads (Ozanne and Ozanne 2013). Despite this, Lyttelton TB was used carry out most of the EM response functions to reduce the threats to personal and public safety as well as some damage to environment and property. All the classification of networks linked to the TM were used to inform, warn, mobilise and alert support, mobilise resources, drive operational response, activate coordination centres, evacuate people and provide immediate relief (Everingham 2014; Jefferies 2014).

All these action, duties and activities were carried out despite CNI failure and was largely driven by the safety net of relationships and skills already embedded into the community (Jefferies 2012). This type of EM response can be explained and understood using what Waugh and Streib (2006) called 'essential roles of networks'. According to Waugh and Streib (2006) modern EM presents a paradox which requires response to be meticulously organised and planned while also encouraging spontaneous actions based on needs (p.132). Emergency managers often need to improvise, adapt and be innovative because circumstances might present itself in different ways from the perfectly documented EM plans. So while the role of government is central to the coordination of EM response, response also draws on a wide range of essential community economic, social,

psychological and political resources which are mobilised by networks of organisations and individual volunteers (Waugh and Streib 2006 p.133).

These resources form the essential networks whose roles contribute to both tactical and operational response during major incidents. The mass population response to major incident in Lyttelton has shown that the involvement of non-governmental actors using networks and nets of relationships embedded in the community (Jefferies 2012) are central to 'Emergency' response. It is also evident that these networks can build capacity of communities to deal with major incidents and make them more disaster resilient (Waugh and Streib 2006). However, while the role of TM has been crucial in facilitating the response in 2011, it is worth emphasising that service demands during major incidents can escalate tremendously which exceeds community capacities and networks as experienced during the March 2011 Japan complex disaster.

Furthermore, the limitation of Lyttelton TM being used as an EM response tool without objective assessment of how its design can better fit into this role was exposed during response to series of flooding experienced in Lyttelton in 2014. The TM was not as effective in facilitating response to flooding as it was to the earthquakes and as such response at the 'emergency' phase was problematic (Everingham 2014). This problem was however managed by drawing from the essential roles of networks to alert, mobilise and evacuate people to safety after a period of TM system breakdown (Everingham 2014). As explained by Waugh and Streib (2006), community can become vulnerable when their internal capacity is permitted to atrophy and when outside resources are unavailable to consolidate them. For example, response to Hurricane Katrina tested the limits of governmental and nongovernmental capacities, thus emphasising that while essential EM capacity is built from ground up drawing from community capacity (Waugh and Streib 2006), it needs to be consolidated by governmental capacities.

This arrangement and understanding will not only enhance social infrastructures with characteristics such as the Lyttelton TM, but also sustain it for future EM or mass population responses. Aldrich argued that major incidents are effectively responded to through mutual assistance and arrangements between emergency services and communities. However, the collaborative arrangements needs to be better understood for us to better prepare to respond to future crisis. In addition, it is important for government to invest in CNI and services which can better withstand the impacts of mega-scale disasters as experienced in recent years.

Response in Riccarton and Christchurch as undertaken by SVA can be classified as the 'Recovery' response. This is evident from the nature of activities implemented by SVA which was largely around

individual support and clean-up in places which were badly affected by liquefaction but still habitable by people (SVA 2014). The SVA were not recorded to have been involved in any major 'Emergency' response and their use of texting and social media indicate that CNI had been partly or fully restored as at the time their operations began. Furthermore, roads had become accessible or opened for use in order for SVA to make delivery of water or support individuals who require major liquefaction clean-up (Lewis 2013).

This clarification is not to trivialise the major contribution of SVA during the earthquake in 2011, but more to identify and define the roles played by various actors during mass population response during this major incident. The distinction is also made so that future roles and responsibilities can be divided along existing community functions, capabilities and resources to facilitate and optimise response without frustrating or overtly demanding the impossible from community actors. An understanding of capabilities and resources within the scope of operational EM response can facilitate resource allocation and policy making to enhance response to future incidents; thus optimising community and EM plans.

For example, the response undertaken by SVA led by Sam Johnson has been explained from a social entrepreneurial perspective stating that their response during this disaster was based on social interrelationships at micro and macro level (Lewis 2013). While this perspective might be true within the entrepreneurial school of thoughts, limiting response solution to emergency and disaster events to entrepreneurial concept is limiting. In a complex world where many uncertainties thrive due to the impact of globalisation, rapid urbanisation, climate change, evolving risks and threats, it is erroneous to infer that "individual's moral commitments to helping people or performing good deeds which is rooted in particular patterns of relationships" (Goss et al 2011 p. 224) are immune to external factors and evolving risks during EM response to large scale incidents. In a nonlinear world, it is doubtful that many individuals, organisations or work will exhibit such extremely stable behaviour over a protracted period of time. Even some of the most stable emergency operation agencies such as the fire, police and ambulance often need to have variation in operation output based on new or evolving risks.

Furthermore, Perrow (2007) argued that complex and large scale disasters exceed the coordination and management of an individual or any entrepreneur, government or nongovernmental organisations. While individual efforts might struggle with sustainability in the long run, collaborative efforts between community stakeholders and government based on structured with flexible arrangements might be key to enhancing social infrastructures (Blanchard 2007). Despite this, mass population response and strategies in Christchurch as led by SVA indicates a good

understanding of systems of human needs as explained by Donahue et al (2012). Donahue et al (2012) explained EM response using an 'All Needs Approach' (ANA) drawing from Maslow hierarchy of needs model. According to them, EM response can be effectively undertaken by responding directly to the needs of the public by systematically using the hierarchy of needs model.

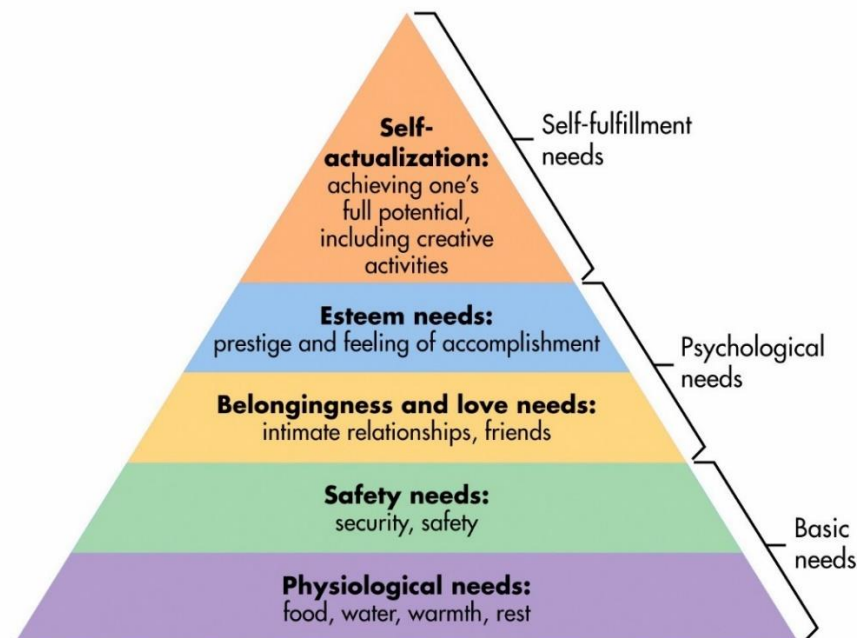


Figure 2. Maslow's Hierarchy of needs
(Adapted from Donahue et al (2012))

According to Donahue et al (2012), using ANA helps to key into public perception of needs satisfaction which also drives public opinion of public administration during EM response. However, this approach to EM response completely lacks provision and suggestion for how the immediate threats to public, personal and environmental safety is to be managed and assessed. Regardless, mass population response to the devastating impacts of major incident in Christchurch is still better explained through the lens of the ANA. Partly because this approach helped SVA to bridge the barriers of rigid preparedness compliance with EM policies (Donahue et al 2012), and mostly because it helped to provide the type of needs required by the people in an urban city setting. Although Maslow's hierarchy of needs was also modified by Donahue et al (2012) by including illuminate supportive and supplemental needs as required at each level of needs or depending on functional needs exhibited by people within a community, this modification still lacks logistics for 'Emergency' response.

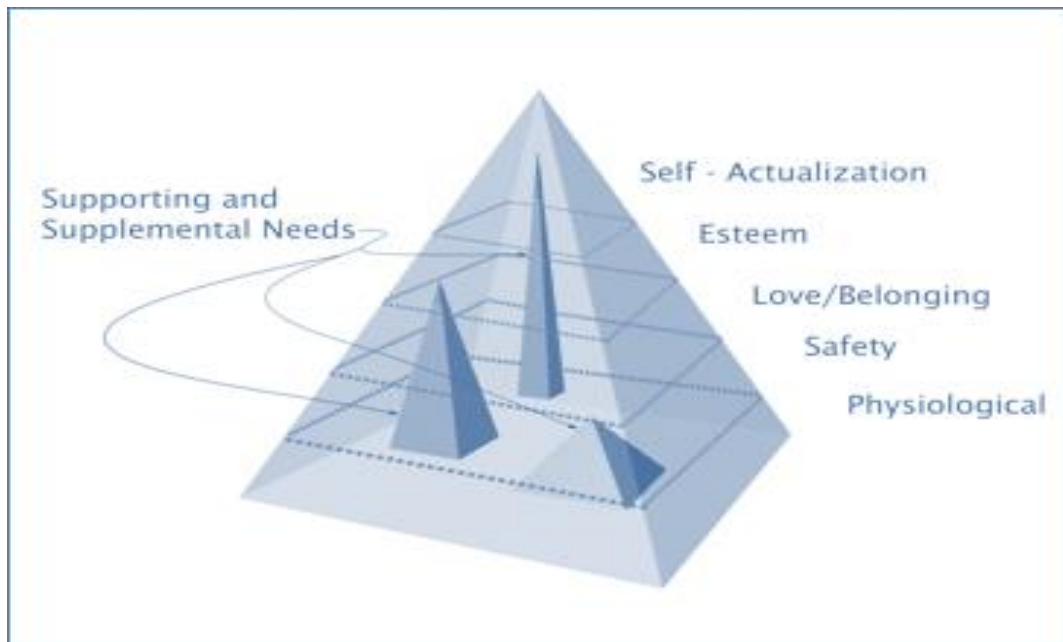


Figure 3. Modified Maslow's hierarchy of needs with illuminate supportive and supplemental needs
(Sourced from Donahue et al. 2012)

It is important that any continued adaptation of this approach should strongly consider the constantly shifting dimensions and myriad of needs which motivates people. Despite this limitation, the ANA fits into the profile of any community irrespective of the level of impacts experienced. For example, in both Lyttelton and Christchurch city, the immediate physiological, safety and love/belonging needs were required at both 'Emergency' and 'Recovery' response phases. While physiological and love/belonging dominated the mass population response strategies inside Christchurch city, in Lyttelton, esteem and self-actualisation needs were indirectly met from achieving physiological, safety and belonging needs (Jefferies 2012; Everingham 2014). For example, the impact and major contribution of TB during the 2011 response was acknowledged by the Canterbury Civil defence and funding was approved to support the TM and to document a written report which captures the role of TM in developing EM local partners for EM in Lyttelton (Everingham 2014).

In addition to this, more people and organisations have joined and linked up with TB project to further enhance the network of skills and resources. The growth of essential networks in Lyttelton post-earthquake period did not only improve the social infrastructures, but also proved useful during response to series of flooding, environmental contamination and landslips in 2014 (Everingham 2014). On the other hand, it is also commendable that the mission of SVA which emphasises community service post-disaster recovery is captured adapted as an academic course to further

educate young people and the community about the approach used by SVA response. While this directly ensures that the 'Recovery' response and approach used by SVA is transferable to others and sustained though this means, public education on hazard knowledge or any form of disaster education is lacking in Lyttelton. Thus, this comparative analysis of EM response within Christchurch indicate that social infrastructures are integral to mass population response to CNI failure and major incidents especially at 'Emergency' phase of response. It is also evident that critical infrastructures are important fabric of any society, which provide means of facilitating mass population response to major incidents in our very modern day world. Regardless of the merits of social infrastructures, the failure or disruption of CNI due to the impact of major incidents can also compound response arrangements. Mass population response as exemplified in Christchurch has drawn on the central role social infrastructures play in operationalizing, mobilising and supporting community during major incidents. However, there is need to acknowledge and replenish the networks which sustain social infrastructures in view of enhancing preparedness for future crisis.

Conclusion

Evidently, unprecedented, major or complex incidents strain CNI and cause major disruptions to continuity of society even in developed economies such as US, UK, Japan, New Zealand etc. Disaster and Emergency events in the last decade has emphasised this. While it will take a huge chunk of time and process to enhance CNI to the level that they can withstand major incidents, the capacities and networks of social infrastructures needs to be increased. The benefits of researching and outlining mass population response to CNI failure or disruption is to identify strength and weakness associated with activities, actions, pattern and resources mobilised during such response in view of optimising response to future crisis and major incidents.

This paper has described the nature of mass population response in Christchurch at the onset of the February 2011 earthquakes which resulted in deaths, disruption of CNI and major environmental impacts, of which the cascading effects of the incident is still felt until date. While the major contribution of mass population response in Lyttelton and the response launched from Riccarton through the SVA have shown the role of social infrastructures in operationalizing such mass population response, major lessons are to be learnt, moving forward.

Therefore, it is important that the merits and limitations of social infrastructures are critically examined through extended research, reports and other established means. But more importantly, government is saddled with the responsibility of improving CNI to a reliable level that essential CNI

can be restored within 24 hours in the event of disruption or failure during major incidents. The 24-hour timeframe is crucial for effective transition between the 'Emergency' response phase and 'Recovery' response. This transition or timeframe also enables the frontline emergency services and agencies to handover to other agencies or organisations to coordinate recovery efforts with focus on needs and community well-being (NZFSC 1998). This paper has briefly brought to light the structures, characteristics and features of social infrastructures as operationalized in Christchurch, New Zealand; an area where opportunities for further research in EM response abound.

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