



# The “Lac-Mégantic tragedy” seen through the lens of the EnRiCH Community Resilience Framework for High-Risk Populations

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## Abstract

**Setting** On July 6, 2013, a train carrying oil derailed in downtown Lac-Mégantic (Quebec, Canada), causing major human, environmental, and economic impacts. We aim to describe, and learn from, public health strategies developed to enhance community resilience following the train derailment through the lens of the EnRiCH Community Resilience Framework for High-Risk Populations.

**Intervention** Annual population-level surveys were conducted in Lac-Mégantic and surrounding areas to assess the long-term impacts of the disaster. Findings suggested that a solid upstream investment towards the development of adaptive capacity was needed. A “Day of Reflection” bringing together local stakeholders and citizens was organized, inspiring the elaboration of an innovative action plan. Leaders advocated for funding to support its implementation, leading to a substantial investment from the provincial government. Through a wide range of actions, the plan aims to bring psychosocial services closer to people, stay connected with the community, and foster community engagement.

**Outcomes** Several lessons have been identified. After a disaster, there needs to be a balanced focus between the gaps/needs and strengths/capacities of a community. Moreover, public health actors must collaborate closely, all along the continuum of the upstream-downstream paradigm, with local organizations and citizens.

**Implications** This unique experience, supported by an empirically-based framework, suggests that three vital ingredients are required for success in recovering from a disaster: (1) fostering community strengths and valuing citizen participation, (2) a strong political commitment to support upstream actions, and (3) a public health team able to support these actions.

## Résumé

**Contexte** Le 6 juillet 2013, un train transportant du pétrole déraillait au centre-ville de Lac-Mégantic (Québec, Canada), causant des impacts majeurs sur le plan humain, environnemental et économique. Notre objectif est de décrire les stratégies de santé publique développées pour favoriser la résilience communautaire suivant la tragédie ferroviaire et d’en tirer des leçons, à travers la lentille du « EnRiCH Community Resilience Framework for High-Risk Populations ».

**Intervention** Des enquêtes populationnelles ont été réalisées annuellement à Lac-Mégantic et les environs pour examiner les conséquences à long terme de la catastrophe. Les résultats suggèrent qu’un important effort en amont était nécessaire afin de développer la capacité d’adaptation. Une journée de réflexion rassemblant des partenaires locaux et des citoyens a été organisée, inspirant l’élaboration d’un plan d’action innovant. Les leaders ont plaidé pour l’obtention d’un financement afin de soutenir son implantation, ce qui a mené à un investissement substantiel du gouvernement du Québec. À travers un large éventail d’actions, le plan vise à rapprocher les services psychosociaux de la population, rester connecté avec la communauté et promouvoir la mobilisation communautaire.

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**Retombées** Plusieurs leçons ont été tirées. Après une catastrophe, on doit porter une attention à la fois sur les lacunes/besoins et les forces/capacités de la communauté. De plus, les acteurs de santé publique doivent collaborer étroitement, autant en amont qu'en aval, avec les organisations locales et les citoyens.

**Implications** Cette expérience unique, soutenue par un cadre fondé sur des données empiriques, suggère que trois composantes sont essentielles au succès du rétablissement post-catastrophe: (1) la valorisation des forces de la communauté et de la participation citoyenne, (2) un engagement politique fort pour soutenir les actions en amont, et (3) une équipe de santé publique capable de soutenir ces actions.

**Keywords** Resilience, psychological · Disaster · Community participation

**Mots-clés** Résilience, psychologique · Catastrophe · Participation communautaire

## Introduction

Public health response during and after disasters has traditionally been focused on protecting populations from chemical, biological, and physical threats, particularly among high-risk groups (Généreux et al. 2015, 2016a). However, the role of public health organizations in monitoring post-disaster psychological impacts, supporting local authorities and communities, and enhancing community resilience in the longer term may be just as important. Community resilience can be defined as mobilizing adaptive capacity to respond and recover from a disaster or a disruptive event (Maltais et al. 2016), yet building such adaptive capacity is a challenge for public health organizations. While ideally this would happen before the event, more often it will have to be done afterwards, as is the case in this study.

There is currently a gap in evidence-based community-level strategies designed to enhance resilience, health, social functioning, and well-being in post-disaster contexts. While much is known about interventions targeting health needs and vulnerabilities following emergencies and disasters (i.e., deficit-based models), less is known about what could foster individual or community resilience. This tendency to focus on problems and needs of populations requires significant resources and could promote dependency on limited services (Kretzmann and Mcknight 1993; Ziglio et al. 2000). This leads to interventions working on deficits rather than fostering capacities or resources. To shift the focus towards what produces health instead of diseases, an asset-based model was proposed (Morgan and Ziglio 2007). This model is based on the salutogenic theory (Antonovsky 1987, 1996) to fulfill the need for an evidence-based (or at least evidence-informed) intervention. Disaster management and the asset-based model in health promotion are more intertwined than one could imagine, informing and complementing one another. Indeed, several concepts of both fields (e.g., resilience, empowerment, citizen engagement, community development) could help to bridge the gap between the salutogenic perspective and public health practices in the aftermath of disasters.

## An evidence-based framework

The EnRiCH International Collaboration is a community-based participatory research initiative and international community of practices, based at the University of Ottawa. It aims to promote collaboration and inclusive engagement in support of community resilience of groups who are at disproportionately high risk, as part of an upstream asset-based approach to disaster management. Here, the term high-risk populations is defined as “anyone who has functional limitations related to communication, housing, awareness, mobility/transportation, psychosocial factors, self-care/daily tasks, and safety/security that may put them at higher risk of negative impacts when an emergency or disaster occurs” (O’Sullivan et al. 2014). Based on qualitative research conducted in five communities in Canada and extant literature, a framework was developed to support an integrated upstream-downstream approach combining principles from various fields (e.g., disaster management, health promotion, community development) (O’Sullivan et al. 2014). The upstream-downstream paradigm in the public health field describes preventive and reactive interventions. Downstream interventions refer to the response phase following an adverse event while upstream refers to interventions aimed at preventing the negative impacts of a potential future event.

Within the EnRiCH framework, upstream and downstream strategies are presented as a cyclical process that integrates the four phases of disaster management (prevention/mitigation, preparedness, response, recovery) in the development and use of adaptive capacity (O’Sullivan et al. 2014). Placed at the centre, adaptive capacity is surrounded by three core drivers (i.e., empowerment, innovation, collaboration) and four strategic areas for intervention (i.e., upstream leadership, asset/resource management, awareness/communication, connectedness/engagement). Each component of the framework is embedded within the complexity and the culture of a community.

The EnRiCH Community Resilience Framework for High-Risk Populations (Fig. 1) was developed upstream. It was built upon empirical research including, among others, a table top exercise involving a disaster scenario (i.e., a train

derailment with chemical spill) to assess the relevance of community-level interventions (e.g., asset-mapping); however, it has not yet been applied in a downstream context, following a large-scale disaster. This paper proposes an application of this framework in a downstream context, based on a case study from Lac-Mégantic (Quebec, Canada) to check if, and how, the components highlighted by the framework translate into concrete public health actions.

## Setting

On July 6, 2013, a train carrying 72 cars of oil derailed in downtown Lac-Mégantic in the Eastern Townships region of Quebec, Canada. The derailment provoked a major conflagration and a series of explosions. This disaster caused 47 deaths, the destruction of 44 homes and businesses, the evacuation of 2000 citizens (i.e., a third of the local population), and an unparalleled oil spill (i.e., 6,000,000 L of crude oil spilt into the environment). This unprecedented event, notoriously known as “The Lac-Mégantic tragedy”, caused major human, environmental, and economic impacts. Over the first 3 years following the tragedy, the Eastern Townships Public Health Department (PHD) has undertaken several actions, initially intended to protect the public’s health by minimizing environmental health risks to the population, then to monitor physical health and psychological consequences. Repeated cross-sectional health surveys were conducted annually after the train crash by public health practitioners and academics. The findings showed persistent and widespread mental health needs 2 years following the tragedy. This evolving situation led to a progressive shift in PHD approach, from a deficit-based towards an asset-based approach. Moreover, since mental health services in Quebec focus on curative care offered in clinical settings after disasters, PHD aimed to complement these services with population and high-risk population health approaches. It therefore intensified its work with the community to promote recovery and foster adaptive capacity. Drawing on partnerships within the EnRiCH International Collaboration, the organization was briefed on key elements of the framework and, consequently, developed upstream-downstream strategies to support adaptive capacity.

Our recent experience in Lac-Mégantic clearly demonstrates that disaster management and asset-based approaches must co-exist to foster a more comprehensive public health response. In this paper, we aim to (a) describe community-level strategies put in place by the Eastern Townships PHD to enhance community resilience following the “Lac-Mégantic tragedy,” through the lens of the EnRiCH Community Resilience Framework for High-Risk Populations, and (b) identify lessons learned and avenues for improving long-term public health response to disasters.

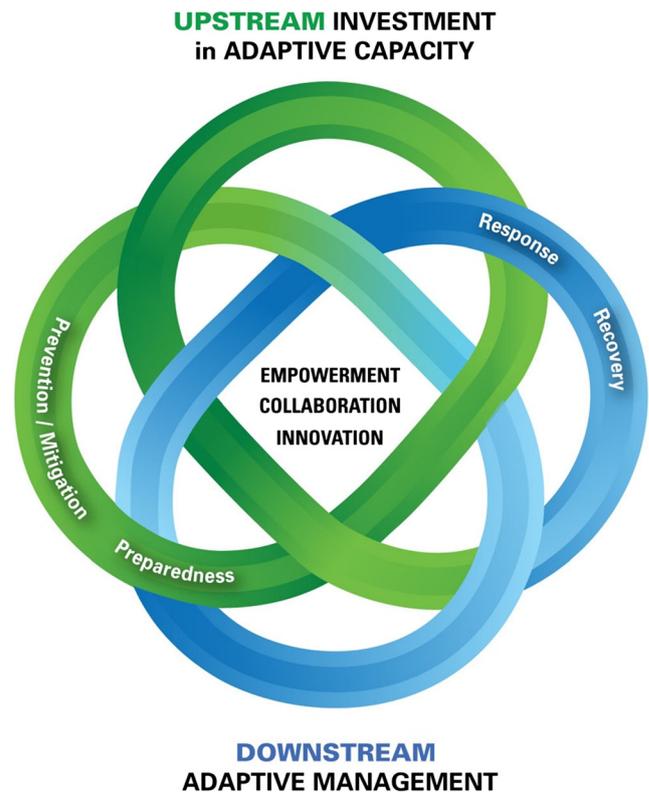


Fig. 1 The EnRiCH Community Resilience Framework for High-Risk Populations (O’Sullivan et al. 2014)

## Intervention

### Strategies to enhance community resilience following the tragedy

As mentioned above, the Eastern Townships PHD, in collaboration with the Université du Québec à Chicoutimi, has conducted three repeated cross-sectional surveys among large and representative samples of adults living in Lac-Mégantic and surrounding areas (i.e., about 800 participants in each survey). People aged 18 years or more were selected based on a random digit-dial (RDD) procedure including cellular phones. An acceptable response rate of almost 50% was obtained for each survey. These surveys have served to assess the long-term outcomes associated with exposure to the tragedy (Généreux et al. 2016b; Généreux and Maltais 2017; Maltais et al. 2015). Due to psychological and psychosocial issues among direct victims, which were observed by frontline health workers, PHD expected to observe similar effects of the disaster in the wider community. Overall, 76% of adults living in Lac-Mégantic and surrounding areas reported human losses (e.g., loss of a loved one), material losses (e.g., home damage), or subjective losses (e.g., perceiving the event as having adverse effects in the future) related to the train derailment. About a fifth (17%) of the population even reported all three types of losses and was then considered as highly exposed.

The second survey, conducted in fall 2015 (more than 2 years following the disaster), revealed that 76% of these highly exposed individuals still showed moderate to severe signs of post-traumatic stress (Généreux et al. 2016b).

Given these facts, PHD leaders felt that a deficit approach was no longer sufficient, and a solid investment toward the development of adaptive capacity at the community level was needed. Indeed, results from the second survey, disseminated first to local partners, then to media and political leaders on February 2016, served as a powerful lever for community mobilization and political advocacy. A “Day of Reflection” bringing together about 50 representatives of various local organizations and citizen groups was organized by the PHD and local leaders in March 2016. Throughout this day, participants shared their understanding of local needs and assets, looked backward at what had been accomplished, determined an ideal vision of the community, and identified priorities for action. A multi-sectoral action plan was then developed to increase community resilience and foster health of the local population. In the weeks following the elaboration of the plan (i.e., April 2016), PHD advocated for additional funding to support its implementation. In June 2016, the Quebec Health and Social Services Ministry announced a substantial investment that would provide adequate resources to sustain the adopted action plan.

Through a wide range of actions, largely based on community development and health promotion principles, our plan pursued these objectives: to (1) maintain and adapt psychosocial services to individual and community needs (bringing them closer to people), (2) stay connected with the community, and (3) foster community engagement. The actions were diversified, ranging from the creation of a collective garden to the implementation of a community outreach team. The following table (Table 1) provides details on actions of this plan and how they relate to EnRiCH Community Resilience Framework for High-Risk Populations.

## Outcomes

Each public health intervention provided during the recovery phase of a disaster should be evaluated to determine its value and provide evidence for establishing standards and best practices (Birbaum et al. 2016). However, there is a paucity of evaluations of such interventions in the scientific literature. It is often not possible to identify the public health interventions provided during the recovery processes, much less their outcomes in the affected populations (Adibhatia et al. 2015). Since it is challenging to conduct high-quality studies (i.e., randomized or prospective cohort studies) in disaster settings, interventional disaster research is usually limited to other designs such as cross-sectional or pre-post studies. In Lac-Mégantic and surrounding areas, three cross-sectional surveys

allowed us to monitor annual trends from 2014 to 2016 for several outcomes. Since the mobilization of the local community immediately started after the dissemination of the 2015 survey findings, one could assume that some changes in psychological outcomes between 2015 and 2016 were attributable to public health interventions provided during that year. A significant decrease in moderate to severe post-traumatic stress reactions from 67% prevalence to 49% prevalence was observed in Lac-Mégantic community between 2015 and 2016.

Interestingly, the proportion of highly exposed residents who sought professional help during the past year significantly dropped from 31% in 2014 to 21% in 2015, before rising again to 26% in 2016, suggesting that speaking publicly about the psychological suffering and bringing social services closer to people promoted help-seeking behaviours (Généreux and Maltais 2017). Other signs of recovery were also observed in the community in 2016, including post-traumatic growth (Généreux and Maltais 2017).

## Discussion

In the absence of control groups, it is not possible to determine whether the changes in mental health outcomes observed over time in Lac-Mégantic would have occurred naturally, without any intervention. However, many studies have reported prolonged negative effects, notably persistence of post-traumatic stress symptoms (PSS), for years following natural, technological, and man-made disasters. A longitudinal study conducted 8 years after the flood of July 1996 (Quebec, Canada) observed significant differences between victims and non-victims regarding PSS (Maltais et al. 2009). Ten years following an oil platform disaster, post-traumatic stress disorder was observed among 21% of the survivors (Hull et al. 2002). Similarly, the long-term mental health impacts (e.g., increased rates of PTSD) remain a public health challenge 25 years after the Chernobyl accident (Bromet et al. 2011). The change in PSS may not be linear. Over a 5-year period after an industrial disaster, PSS evolved for the first 15 months after trauma exposure and then remained stable (Bui et al. 2010). A key factor that may influence the course of PSS is adaptive capacity. Coping self-efficacy partially mediated the relationship between PSS at year 4 and PSS at year 10 following the Enschede fireworks disaster (Netherlands, 2000) (Bosmans et al. 2013). Such findings stress the importance of taking into account the unmet needs for psychosocial services in the affected communities and developing evidence-based strategies to strengthen resilience, which has and continues to be done in Lac-Mégantic.

**Table 1** Community-level activities to enhance community resilience in Lac-Mégantic, based on the EnRiCH Community Resilience Framework for High-Risk Populations

Components of the framework	Description of the components	Activities deployed in Lac-Mégantic action plan
Adaptive capacity	Flexibility to changing context	- Health surveys as a powerful lever for community mobilization and political advocacy, leading to the organization of a Day of Reflection and, subsequently, to the elaboration of a multi-sectoral action plan to meet changing demands (see below)
Core drivers		
Empowerment	Power given to activate assets and opportunities to participate	- Citizen participation as an overarching principle of the action plan (see below)
Collaboration	Relationships among agents to build awareness and common ground	- Day of reflection organized with local organizations* and citizen groups to develop a shared understanding of the needs and assets. - During this day, looking at the road we had traveled and imagining the route for the future (the ideal vision of the community)
Innovation	Emergence of new practices, reconfiguration of systems	- Permanent outreach team (3 health professionals hired) located outside formal clinical settings, to bring psychosocial services closer to the people - Terms of reference and evaluation of the outreach team (lessons learned and knowledge sharing) - Collaboration on a SSHRC-funded research project aimed at understanding the resilience processes
Strategic areas for intervention		
Awareness/communication	Information exchange, collaborative learning and asset literacy at all levels	- Health surveys emphasizing both needs and strengths of the community - Results shared with organizations and citizen groups prior to the media (micro- and meso-levels) - Results disseminated to political leaders (macro-level) to raise their awareness - Providing the community with knowledge from previous experiences with disasters ( <i>Are we "normal?"</i> )
Asset/resource management	Mapping and articulating connections between assets in the community	- Shift from a deficit- to an asset-model through a positive public relations campaign - PhotoVoice initiative to give power to the voices of the people, to identify assets - Mixed-method research study with children and youth, to identify their specific assets and needs
Upstream-oriented leadership	Championing through a collective vision and upstream investment	- Initiatives from the plan entirely funded by the Québec Health and Social Services Ministry (political commitment)
Connectedness/engagement	Network of people and organizations established to foster engagement	- Action plan developed and coordinated through an all-of-society approach (with local organizations/citizen groups) - Collaboration with schools and youth organizations - Various innovative initiatives to stay connected with the community and break the isolation of high-risk individuals (e.g., collective garden and other gathering spaces)
Complexity	Dynamic context, non-linearity, interconnectivity	- Daily interactions between the outreach team and citizens and local organizations to listen and learn about people - Rebalance of upstream and downstream strategies as the situation evolves
Culture	Context of a specific community	- Monthly meetings (whole day) with the outreach team and other stakeholders to understand the state of the situation, follow trends and tailor actions if needed

\*Including the following: health, education, municipal government, private sector, and non-profit organizations

### Lessons learned and avenues for improving long-term public health response to disasters

Having been through a very unique and informative experience, the local public health workforce, in close collaboration with the researchers and the community members, identified critical success factors for sustaining resilience and recovery in the aftermath of a disaster. First overall, long-term

monitoring of both physical and psychological impacts through population-level surveys is essential. On the one hand, such surveys, done downstream, serve as powerful tools for upstream health promotion initiatives and political advocacy. On the other hand, these surveys could contribute to upstream preparedness when recovery turns the loop and becomes upstream again. In fact, population health surveys were so helpful in terms of recognizing the full scope of the local issues and needs at the community level that we recommend

its use for upstream strategies for any future major events. Such community-based studies support priority setting (e.g., targeting most at-risk populations, including citizens who had the highest tragedy exposure and experienced significant losses) and promote risk-informed decision-making. Second, we learned that the voices of various groups who are at disproportionately high risk (e.g., people with functional limitations related to psychosocial factors) should be heard, with approaches being tailored to their specific needs and assets. It is important to take time to listen and learn from people and consider all members of the community as assets. One way to hear these voices is to offer flexible services that reach out to isolated people in the community where they live. Third, no matter what the extent of the problems observed on the ground, public health focus needs to be better balanced between the gaps/needs and strengths/capacities of a community. To do so, it is imperative to have understanding as well as skills to support both approaches. Fourth, public health practitioners, academics, and leaders must collaborate closely, all along the continuum of the upstream-downstream paradigm, with local organizations and citizen groups. This is fundamental for successful recovery. Fifth, the citizens must always be placed at the heart of all considerations, especially under complex circumstances, where economic and political considerations may tend to take precedence over citizens' interest. Finally, we truly believe that public health organizations should capitalize on existing knowledge, to develop and apply strategies and interventions in a post-disaster context. As part of their recovery operations, they should also build knowledge by sharing experiences and lessons learned.

The EnRiCH Community Resilience Framework for High-Risk Populations has influenced public health strategies and interventions in Lac-Mégantic over the last few years. Interestingly, this innovative framework, published in 2014, aligns with the Sendai Framework for Disaster Risk Reduction (2015–2030) which was adopted by the United Nations in March 2015 (United Nations 2015). Health resilience is strongly promoted throughout this international framework, which puts a strong emphasis on disaster risk reduction and disaster risk management, as opposed to disaster management. Instead of focusing on the event per se (i.e., the disaster), disaster risk management aims at preventing new, reducing existing, and managing residual risks, all of which contribute to strengthening resilience. It promotes several principles that tie in closely with the EnRiCH framework, including the management of the risk of disasters by protecting persons, their assets, and their rights; all-of-society engagement through inclusive participation; all-of-state institutional engagement; empowerment of local authorities and communities; understanding of local and specific characteristics; and risk reduction in the post-disaster recovery by “Building Back Better.”

A lot of work remains to be done to increase Canadian local emergency preparedness. Our country needs more evidence-informed strategies to enhance community resilience in the four phases of disaster management. Promoting adaptation and recovery in post-disaster settings is one thing, but in both The EnRiCH and Sendai frameworks, there is an emphasis on advocacy for more upstream activities and policy initiatives to adapt to unforeseen events.

## Implications

Despite the difficulty in evaluating the direct impact of public health efforts provided in Lac-Mégantic over the past years, the recent improvement in mental health outcomes noted throughout the three annual population surveys may be (at least partially) attributable to these interventions (Généreux and Maltais 2017). It should be noted that in addition to these encouraging findings, a more thorough evaluation of our newly implemented outreach team is currently underway. A fourth health survey will also be conducted in summer 2018, 5 years after the train derailment, to evaluate longer-term impacts of our interventions.

This case study gives a concrete example of how bridging between disaster management and asset-based approaches can be fruitful for enhancing community resilience and improving the health and well-being of a community. To achieve such ambitious goals, public health organizations need to rely on solid and rigorous empirical evidence on community-level initiatives designed to enhance resilience. The EnRiCH Community Resilience Framework for High-Risk Populations, promoting an asset-based approach, provides such evidence.

Resilience processes are decisive parameters for health and well-being of communities affected by a disaster or other disruptive events. Our experience, supported by a community resilience framework based on empirical research, strongly suggests that three vital ingredients are required for success in recovering from a disaster. Such ingredients are (1) recognition of community strengths and the value of citizen participation, (2) strong political commitment to support upstream multi-sectoral actions, and (3) a public health team able to support these actions.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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