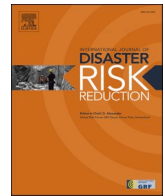




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Collaborative planning principles for disaster preparedness

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ABSTRACT

Natural and technological hazards can have consequences of a scale and severity far exceeding most human experience. Massive earthquakes predicted as imminent for some regions of the world, fires engulfing large tracts of land and the global COVID-19 pandemic of 2020 illustrate several key preparedness challenges. The hazards literature stresses the importance of involving communities in decisions before, during and after calamitous events occur. Currently, community planning and hazard risk management planning are largely carried out in separate tracks that seldom intersect. We propose that hazard risk managers may benefit from integrating in their approaches collaborative planning principles, especially at the pre-disaster stage. We further propose that community planners deliberately consider hazards and integrate the potential consequences of a disaster into routine plan-making, boosting communities' resilience. Finally, since citizen involvement is necessary but burdensome in both planning and hazards management, we suggest a set of criteria for considering who—from among the many community and public stakeholders—should be involved, when, and how.

1. Introduction

Acute and incremental natural and technological hazards such as earthquakes, pandemics, nuclear facility malfunctions, toxic chemical leaks, or sea level rise have both immediate and long-term consequences for the affected communities. At times, their scale and severity can exceed by far most human experience. Recent events around the world—wildfires in California, Oregon and Washington State in 2020 and eastern Australia in 2019-20, the six quakes of 6.0 m or greater in Indonesia in 2018 and the COVID-19 global pandemic in 2020—suggest there is no shortage of calamitous events, some more predictable than others. It is, however, our collective lack of preparedness that sets the stage for what we call “disasters.” That is, whereas hazardous events inevitably occur, it is the social response to them that feeds disasters.¹

We begin by reviewing some of the challenges to engaging communities in preparedness to face disasters. We review briefly the conditions and characteristics of effective community engagement. We suggest performing periodically a decision- and temporally-sensitive

stakeholder analysis to address (a) who among three groups of actors—the professional planning team, stakeholders, and the larger community—should be involved; (b) in which decisions and (c) at what critical points. Then we identify key elements from planning theory that make collaborative work effective, weaving in negotiation concepts/techniques, such as understanding each party's interests and motivations, dealing with expertise and local knowledge, and using temporal differences in priorities to come to agreement on solutions.

2. Obstacles to community engagement in disaster preparedness

Preparing and planning for sudden, unexpected or rare large-scale events is challenging for several reasons. They include the uncertain timing, lack of collective memory about consequences in past events, lack of political will to prepare, the need to invest scarce resources in pressing immediate needs rather than in preparing for the future, the *wicked problem* structure of the hazard-response systems, and the uniqueness of catastrophes and their contexts.

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¹ Abbreviations: COVID-19: Coronavirus; FEMA: Federal Emergency Management Agency.

First, there is high uncertainty regarding when and where a specific hazard will strike, even when relatively frequent, which natural, built, and social systems will be affected, and how. There is correspondingly high uncertainty with respect to the nature, costs and consequences of various mitigation and response actions [1]. Decision making for an unclear future with lack of specificity about benefits and costs is cognitively difficult for individuals and potentially contentious for groups [2]. A case in point: despite warnings by well-respected leaders regarding the possibility of a global pandemic,² we have learned in 2020 that we were quite unprepared for the COVID pandemic when it struck.

A second challenge resulting in inaction is lack of collective memory of previous experiences. Some crises are one-time idiosyncratic occurrences at a specific location, such as the Exxon Valdez or the British Petroleum massive oil spills. Others—some floods, earthquakes and pandemics—recur, but at time intervals that exceed the life span (and memory) of one generation. Borrowing from Michelle Wucker's *Gray Rhino* [3] metaphor, describing probable but neglected threats that have an enormous impact, we call such events *generational gray rhinos*: although they occur with near-predictable (low) frequency, these events surprise as if they had never happened before because in fact, for many of the current communities of the world, they never have. Some examples of generational gray rhinos follow.

- In 2016, heavy rains caused the Seine River to rise to a level not seen since 1910. It took many days to subside. Flooding caused extensive damage and forced the closure of Paris metro lines and of museums whose precious collections, stored in basements, were threatened. The 1910 flood, whose level is clearly marked along the river channel, had faded from memories sufficiently to take any urgency out of the need for preparedness.
- The 'usual suspects' threatening life and well-being in the Middle East are war and terrorism. Much less salient, though with consequences of equal or greater magnitude, is a destructive 90-year earthquake waiting to happen in the eastern Mediterranean, imperiling the countries adjacent to the Jordan Rift Valley: Syria, Lebanon, Jordan, Israel and the Palestinian Authority. The last major earthquake occurred there in 1927, placing it outside the memory of the vast majority of today's population, though well within the immediate future. Based on direct experience, people in the Middle East may think of their homelands as an earthquake-free zone. This places earthquakes rather low on the public's and politicians' agendas.

Gray rhino calamities can devastate communities by destroying lives, social and communication networks, physical structures, and the supply of, and access to vital commodities and services; consequences may turn even deadlier due to low readiness at all governance levels [4]. Our lack of collective memory of gray rhino disasters dilutes our will to act.

A third reason for the lack of planning for hazards is the reluctance of politicians to invest already-taxed budgets in planning for low-likelihood events whose benefits may not become visible until long after they have left office. A fourth and related reason for resistance to

² Bill Gates in 2010: "Hopefully this outbreak will serve as a wakeup call to get us to invest in better capabilities, because more epidemics will come in the decades ahead and there is no guarantee we will be lucky next time. The 1918 flu killed more than 50 million people. Nothing other than bioterrorism could kill that many people again, and most of the things we need to do to reduce the impact of an epidemic will also reduce the impact of bioterrorism." Also, "The impact of a huge epidemic, like a flu epidemic, would be phenomenal because all the supply chains would break down. There'd be a lot of panic. Many of our systems would be overloaded," Gates told CBS News from the 2017 World Economic Forum in Davos, Switzerland. "But being ready for epidemics of different sizes, there's a lot more we should do." President George W. Bush in 2005: "There is no pandemic flu in our country or in the world at this time. But if we wait for a pandemic to appear, it will be too late to prepare. And one day many lives could be needlessly lost because we failed to act today."

planning arises from the community itself (e.g. Refs. [5], in the context of floods): in general, due to the dual effect of scarce resources (e.g. Ref. [6], in the context of bush fires) and seeming lack of immediate threat, the public is far more focused on resolving current, urgent needs, such as deficiencies in housing, food, and education. Even when ad hoc community groups emerge to respond to a hazardous event, their life-span is relatively short (e.g. Ref. [7], in the context of floods), as is their ability to contribute to building resilience and to preparedness for the next disaster.

A fifth challenge to preparedness is the "wicked problem" characteristic of hazards. Rittel and Webber [8] coined the term "wicked problems" to describe situations rife with risks and uncertainties. Such problems hamper public policy making because agreement is lacking even regarding the problem to be solved. With the uncertainty surrounding infrequent large-scale catastrophic events, consensus on what to prepare for and how to do so is very difficult to achieve. Wicked problems defy efforts to delineate their boundaries and identify their causes or map consequences of decisions. Today, nearly 50 years later, we label as "wicked" the problems deriving from the complexity characteristic of all social-ecological systems. Issues that require attention and response cross the boundaries of these systems in terms of social and administrative organization, consequences, and the information and knowledge required for effective policy decisions. O'Toole [9] observed that typical government hierarchy is often ineffective in addressing wicked problems. The possibility for a community to have to deal with more than one hazard at a time (e.g., Ref. [10]) or cascading events contributes to "wickedness." For example, concurrently with the COVID-19 global pandemic there were, in various parts of the world, volcano eruptions, wildfires, droughts, earthquakes, hurricanes and other catastrophic events that further strained everyone's ability to cope. COVID itself, although originally categorized as a health disaster, quickly morphed into an economic and social disaster as well.

A sixth barrier to disaster readiness is that decision makers prepare for, and respond to, catastrophes with inadequate intellectual capital. They tend to approach such situations relying mostly on past experience when, despite shared elements, no two catastrophes are exactly the same, nor are their contexts. While lack of memory about the past is problematic for rallying communities, using experience with a past disaster to prepare for the next also has its perils. Surprise conditions or circumstances are likely to complicate policies that are not tailored to the specific situation at hand. Although risk-taking actions may be necessary, the public and the decision makers alike have little appetite for them. For example, post-9/11 analyses have pinpointed "lack of imagination" as a fatal flaw in both catastrophe planners' and responders' thinking (e.g., Ref. [11,12]). Imagination is necessary for anticipating what might happen in a specific unprecedented catastrophe, and for thinking up and improvising effective responses to emergent events and needs. Exercising such imagination requires courage to take on risk, and the public's trust in institutions and their representatives who would act. However, unless this trust is built over time, it will not exist at moments of need.

Having observed the multiple sources of resistance to investing resources and planning effectively for low-frequency but highly destructive events, academic and professional hazard mitigation literatures continue to stress the importance of community preparedness. Moreover, contrary to historical approaches to emergency management, which have tended to be hierarchical, the disaster preparedness field now encourages a "whole community" or "whole-of-society" approach, entailing community and stakeholder involvement before, during and after a disaster.³ This means drawing the community, including citizens and private and nonprofit organizations into government decision making, and encouraging regulatory agencies to operate in networks,

³ We note that Räsänen et al. [20] have raised the issue of defining *community* in the context of disaster risk reduction.

both horizontally across specialties and vertically across scales ([13–20]). The realization that resources, knowledge/expertise and skills are dispersed and that no single government body can tackle disaster management by itself matches the broader new governance approach seeking to actively include citizens in government work and decision making [21]. There is no longer a question of whether communities should be engaged; now the question is *how* to effectively engage the public and the numerous stakeholders in the “disaster” management process [22,23].

Of the four stages of hazard (or “disaster”) management—mitigation and preparation (before), immediate response (during) and recovery (after), engaging communities at the recovery stage is most compelling because needs are obvious to, and experienced by, everyone. This is also why the *most challenging stage is before an event happens*, when the need for involvement is far less evident to community members and decision makers for reasons noted above. However, at this stage the payoff can be significant in terms of lessening impacts or increasing the speed and efficiency of responses. This is the stage where we see an opportunity to bring together the fields of planning and emergency management for the benefit of both, and share knowledge to refine collaboration strategies both across professional fields and with other stakeholders and the public.

We bring to emergency management practices what we know from collaborative planning and the negotiation principles embedded in it, to help build community resilience in the face of future calamitous events. At the same time, we emphasize the parallel need to include hazard preparedness in ongoing planning processes [24], which is not currently the case. This inclusion ties into resilience arguments [25] especially for communities under threat of low-frequency catastrophic events: if planning were to routinely consider the possibility for some calamitous event (and how the community would respond to it) it would enhance resilience, promote adaptation and even transformation at a time when there is no pressing need to respond in real time. This strategy addresses the challenge of how to engage communities when the need is seemingly not ‘ripe’, by weaving community resilience and disaster planning into everyday planning decisions, within collaborative planning processes which have become the norm at least at local levels.

3. Conditions and characteristics of successful community engagement

Disasters occur on and affect different scales from the local to the global. Our focus on planning and preparedness is at the local level, although disasters such as an earthquake or a hurricane usually impact larger swaths of space encompassing numerous communities. Post-disaster responses need to match the scale of the disaster. However, community engagement in planning and preparedness at the local level can be direct, and willing participants in collaborative processes are more readily identifiable than at higher (regional state, federal) scales. As well, local participants can address their own circumstances and abilities more precisely than when resources allocation decisions are proposed for larger scales. However, local resilience can contribute to shoring up resilience at higher scales.

To heed the call for community engagement in disaster preparedness, we need to ask: what makes it effective and how can it be attained? And is the disaster preparedness context special in this respect?

Several conditions facilitate or impede effective decision and implementation partnerships between the government, the private and nonprofit sectors, and the public. Governmental decision makers can strongly influence some of these. For example, to trigger public involvement in the different stages of a disaster, decision makers can capitalize on the nature of the disaster at hand. While local toxic spills, pipeline explosions or floods may seem to happen to others somewhere else, earthquakes, hurricanes and pandemics create a feeling of ‘shared risk’ throughout society, which lends itself to cultivating a sense of shared responsibility for assessing, mitigating and responding to that

risk [26].

In general, governance—composed of decision makers and decision-making bodies—is deemed good, and by implication trustworthy, when it is participatory, transparent, accountable, equitable, and efficient [27]. Farahmand et al. [28] add to this list institutional congruence, which occurs when governance has “similar, agreed upon or harmonized institutions.” Building the public’s trust in governance is critical to collaborative processes [29]. Trust is more readily built at the local level, where the same actors meet repeatedly in different venues to consider different joint courses of action. At the local scale, trust tends to be carefully tended in the expectation of future encounters. Therefore, locally people form relationships with (and blame) individuals. They are able to keep score of individual trustworthiness. Breach of trust tends to be more costly locally than at broader scales, where interactions are usually less personalized. At higher governance levels it difficult to establish trust, as specific individuals shift in their roles. As a result, people tend to trust/blame agencies.

Policymakers may have less influence in shaping factors other than trust. For instance, O’Brien and Mileti [30] find that the strongest predictor of an individual’s emergency response involvement is the amount of main shock damage experienced. In other words, immediate, close experience tends to be effective in compelling individual action. Thus, it is likely that the extent to which decision makers can cultivate a feeling of collective identification may increase individual readiness to address preparedness, as well as response involvement post-emergency.

Professional and academic literatures on public engagement offer principles and characteristics of effective citizen participation directly relevant to community resilience (e.g. Refs. [31], in the context of hazardous chemicals [26]; in the context of wildfires). FEMA’s [32] manual, “A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action” offers some guidance. We selected here for brief mention several recommendations that match prescriptions for participatory planning processes. FEMA advises:

- *Build and strengthen networks*
- *Include all segments of the population*
- *Understand the community*
- *Empower citizens*
- *Make participation outcomes meaningful*

Note that these recommendations are general and lack how-to, scale, and context specifics, which are likely to differ from one community to another, and from one type of emergency to another.

3.1. Stratified engagement

Before suggesting collaborative planning and negotiation strategies to increase public participation and policy efficacy, we offer a caveat and a way of thinking about the scope of participation called for. Participatory processes are difficult and costly to organize, and take time. Stakeholders are called to sacrifice time they might otherwise devote to work and family, or they might not even be able to afford it. Moreover, community planning and disaster preparedness are not the only issues requiring their attention. Depending on their priorities, they may need to participate in local education issues, housing and food availability, and environmental health and sustainability decisions. Participation in processes laden with science and technology necessitates commitment to regular attendance if everyone’s input is to be informed and meaningful to the decisions at hand. Thus, it becomes rather difficult to get people’s attention and recruit them for regular participation in relatively long-drawn processes [33]. These considerations strengthen our argument for incorporating disaster planning needs into ongoing collaborative planning processes. This strategy harnesses people’s self-interest as reflected in the planning process in which they may already be involved and establishes relationships and lines of communication that can be activated when calamitous events

occur.

That said, we also suggest next how decision makers might think about the need and extent of public involvement in the various decisions regarding disaster preparedness (Table 1). Some climate change impacts, for example, unfold more slowly, albeit predictably (compared to sudden emergencies such as a toxic spill, or a pandemic). Nevertheless, local decision makers can take them into account as they budget for, and implement in the short term, various infrastructure maintenance tasks such as sewer and energy supply lines, or management of riparian corridors (to minimize flood damage), which will sooner or later suffer from climate change effects [34]. Such decisions do not always require public participation efforts. We would classify them as ‘minor’ (Table 1), entailing fairly routine, ongoing actions under the purview of existing agencies. These actions can be tweaked to take account of what might happen down the line. Other such decisions may well be handled through interagency collaboration, especially if they regard technically complex issues in which the public may lack interest and be ill-equipped to handle.

Decisions that require reallocation of resources can be more directly consequential for the public. They may be needed in the short and medium term. Some of these decisions need public participation especially if they regard a realignment of regional priorities and expenditures. Examples include rebalancing the mix of travel modes, or imposing some restrictions on land uses and on the siting of certain facilities to increase safety in case of an emergency.

Lastly, some decisions require changes in behavior patterns, profoundly different reallocation of resources with serious losses to some segment of the public, or the need to reconsider collective values in order to meet both sudden and long-brewing disasters. Such decisions, some with long horizons, need public input.

To assist in the decision whether and how to engage in public participation for specific types of decisions, Table 1 illustrates three mileposts of a range of possibilities for public involvement. Each cell has to be adapted to specific cases in consideration of geographic scale, expected extent of damage (to lives/structures), duration, predictability, and time span until a disaster hits. Previous community experience with similar events is also a consideration. An approach to public participation patterned on Table 1 can accomplish several objectives. It is respectful, using community members’ time sparingly only when their

Table 1
A guide for involving communities sparingly in disaster preparedness decisions.

Time horizon for action (continuum, could be specified by actual times)	Short term	Medium term	Long term
Decision type (by need for community involvement)			
‘Minor,’ routine—steps agencies budget for, and take anyway (e.g., filling potholes), but including in these steps consideration of hazards as part of governance; prudent decisions <i>not requiring participation, consultation or expenditures</i> outside normal maintenance.	X		
Decisions that entail reallocation of resources and changes in decision making processes to maintain natural resources or implement regulatory mandates (e.g., joint action across regional boundaries to maintain forests on public lands and reduce the likelihood of large-scale fires) that <i>can mostly be handled by collaboration/coordination among agencies (depending on case specifics)</i> .	X	X	
Decisions entailing communal behavioral changes or directly affecting stakes and preferences of community members (e.g., large transportation projects or regulator actions that can affect property values or quality of life in the long run), <i>requiring community collaboration/consensus</i> .		X	X

input is critical and meaningful. It takes into account the fact that participatory processes can take longer than one year to organize and implement, so they cannot be rushed for very short-term decision horizons. Lastly, it recommends participation for decisions with long-term impact on community members’ quality of life and economic opportunities.

4. The intersection: disaster preparedness, collaborative planning processes, and negotiation theory

The key elements of effective collaborative planning - networking, making participation meaningful, integrating different knowledge bases, and developing mutual trust - draw from negotiation theory and parallel some of the prescriptions for community engagement in disaster preparedness. Their congruence leads us to make the case that beyond just learning from each other, the two processes should be combined to enhance the effectiveness of each. We discuss next some how-to specifics.

4.1. Networks and participants

Community planning and emergency management involve community stakeholders as well as public agencies with both separate and overlapping responsibilities. Elected officials, agency staff and industries working with various aspects of a community’s physical and social environment are also at times those helping to prepare, respond to, and recover from disasters. That said, each realm has its own community partners, such as community development centers (CDCs) and affordable housing non-profit organizations in the local planning world, and emergency medical technician (EMT) organizations in the emergency management field. Thus, each field has formed its separate networks. Working together, they can significantly expand their shared reach and effectiveness of intervention.

Including “all segments” of the population in a community may seem daunting, but in fact collaboration between the fields means part of the work is already done. The relationships each field has established have helped professionals build a nuanced understanding of the community as a whole, and of its subpopulations. The connections each field has with residents may be quite different. Working together, however, they can merge, expand, and deepen their joint networks to reach a wider segment of the community than each singly.

Participatory public processes raise an enduring question: who ought to be involved? Here, the negotiation and public dispute resolution domains’ influence on planning is instructive. Scholars and practitioners began to recognize the similarity between these processes more than three decades ago ([35,36]) and refined the application of negotiation theory to participatory planning processes ([4,37,38]). A key prescription of collaborative processes is to include the ‘right’ people. There are no universal lists guaranteed to work everywhere. Instead, identifying them in each situation entails conducting a “conflict assessment,” which consists of inventorying who can affect or will be directly affected by a decision on any given issue. The former includes public and private entities making resource allocation and implementation decisions. For the latter, Susskind and Cruikshank [35] proposed four categories:

... those with the necessary standing to claim legal protection; those with sufficient political clout to draw elected and appointed officials into the dispute; those with the power to block implementation of a negotiated agreement; and those with sufficient moral claim ([35], 103).

These criteria provide a starting point for identifying essential participants in any collaborative effort, guided by the need to increase the likelihood of buy-in and implementation. The first two criteria are self-explanatory; the third should be expanded to include not only those with the power to block implementation of a plan, but also those capable of

implementing what has been agreed upon: those with mandate or jurisdiction over specific decision realms, and those in command of critical resources (physical- and knowledge-wise), such as emergency response professionals. They ought to be included in the collaborative planning process because recovery plan implementation will depend on their standing to make decisions, and on their skills and knowledge. Another group contains on-the-ground community members with up-to-date knowledge regarding residents and resources available locally.

The fourth criterion, referring to those with sufficient moral claim, is quite critical to the success of participatory processes. It acknowledges that our legal system is continually evolving and arguably incomplete. Therefore, those a community believes will be significantly impacted by a decision ought to have representation in a collaborative planning process despite what current law states about their standing. For example, thousands are 'house-less' in cities around the globe. Without a home address, they are bureaucratically non-existent and therefore not represented even in otherwise democratic systems. However, already lacking basic shelter, water and medical care, these residents are likely to have even less during a calamitous event. They should be represented in any planning and preparedness activity. (We note that some homeless persons are likely to survive a calamitous event and may be highly resourceful and therefore able and willing to help others.) If, having to contend with multiple challenges, homeless persons may be unable to participate directly, it is necessary to identify advocates for their concerns.

We propose a fifth criterion for inclusion in collaborative processes: self-selection. First, since it is difficult to know in advance who will be hurt or incapacitated and who will be helpful post-calamity, following an "all hands on deck" approach makes sense. Second, according to Ref. [38], there is a pragmatic reason to strive for broad inclusivity. Innes and Booher (2010) contributed to collaborative planning theory through their DIAD model (Diversity, Interdependence, Authentic Dialogue, [38]). They made the case that including anyone who wants to participate is wise. This includes even vocally oppositional individuals. Excluding them may seem expeditious, but doing so could fuel distracting or destructive dynamics and undermine any agreement. This recommendation of including a diverse array of community members is even more valuable in the context of disaster recovery planning.

4.2. Meaningful participation: self-interest for mutual gain and community well-being

What does it mean in practice to "understand the community" as FEMA recommends? Negotiation theory ([35,39]) can shed light on this point. It holds that effective collaborative processes should make the most of participants' primary concern: their own welfare and self-interest. Stakeholders become motivated to participate in decision processes when they expect to lose or gain something they value, that is, having "skin in the game." Moreover, since participation comes at a cost for organizations and individuals, it is likely to be undertaken only if participants see value in it. Uncertain events, especially when perceived as laying far in the future (generational gray rhinos such as 100-year earthquakes, pandemics or floods), are a barrier to participation precisely because of the ambiguity individuals experience regarding what they have at risk, while participation costs loom large in the present. At times, community members need help to see participation benefits.

A strategy that can open doors for creative decision making in both planning and hazard preparedness processes is asking assembled stakeholders what they are most concerned about today. Then, rather than focusing solely on today's problems or only on how to mitigate or respond to an event at an unknown point in the future, the participants might seek solutions that respond to both objectives. Finding "why" participants prefer specific proposals can reveal the interests and priorities of residents and of local governments and emergency responders respectively. Then participants can focus on what they care about (interests), rather than on the solutions they favor (positions). This

approach of surfacing interests and focusing on them (also a negotiation strategy) nurtures a climate for generating alternative ways to satisfy most of them and can yield solutions that meet multiple needs.

For example, local government and emergency responders might stress mitigation—through construction of structures or equipment needed for a speedy response to a disaster—while residents might be more concerned about the current dearth of affordable housing causing city workers to live far from their jobs. At first blush, these concerns seem distinct, or even necessitating actions that compete for the same limited resources. Further probing might reveal that the mitigation strategies aim to reduce damage to life and property; provision of affordable housing might enable trained local public servants familiar with the community to be at hand, ready to quickly offer the assistance needed in emergency situations. The COVID pandemic brought out just such problems in New York City. First responders lacked affordable housing close to their workplace. Some endangered their lives by using public transportation to go to work, while others had to live in tents away from their families but close to the hospitals where they are employed. Affordable housing for these first responders near critical facilities such as hospitals might have been helpful in reducing infection rates and transportation costs besides contributing to COVID response effectiveness.

When we engage communities in resolving each problem separately, emergency preparedness for future hazards is likely to be the loser. Unpacking the interests and priorities of residents together with those of the emergency responders can inform public funding decisions to benefit the concerns of both groups. This approach builds on the theory of principled negotiation and mutual gains by not only focusing on shared stakeholder interests and creating joint gains, but also identifying which of their interests can be met today and which after a devastating event. This approach takes advantage of the temporal characteristics of different priorities and different risk attitudes among stakeholders ([4, 40], 361).

Appreciation of all stakeholders' priorities even when they diverge from the main objective of recovery planning is critical to fostering broad community participation and support. Discovery of opportunities for mutual gains can be used to overcome elected officials' paralysis and reluctance to invest in long-term outcomes, and community members' inertia. Note that generating plans that yield multiple benefits to satisfy diverse interests is a smart, if challenging way to engage in any type of planning. We propose that anticipation of large-scale catastrophes and integration of preparatory actions as a routine concern in community planning increases both immediate and long-term benefits. The key point here is that stakeholders' attention and willingness to allocate resources to pre-disaster planning hinge on incentivizing them by including short-range, tangible benefits which are not contingent on a future, rare hazardous event.

4.3. Integrating different knowledge bases and knowledge sharing

Borrowing from negotiation theory, collaborative planning offers a strategy for the dealing with different epistemologies, and specifically for integrating local and expert knowledge. Disaster risk management entails expert modeling of some of the consequences of future catastrophic events. For example, experts develop geological or hydrological models and propose technological solutions to mitigate potential harms. Despite the appearance of scientific precision, the resulting information is often rife with uncertainty stemming from the incomplete state of knowledge and limited data availability at the necessary scale. From the public' perspective, the uncertainty—if communicated—is unsettling and compounded by opaque methodologies [41], data derived from larger-scale sources that may be insensitive to local micro-environments, and results expressed in terms often inaccessible to lay listeners. Local residents tend to have difficulty communicating with scientists and technical experts, whom they tend to perceive as deaf to their perspectives or biased by links to engineering firms producing the

models and solutions. As a result, they may disconnect from the collaborative process or accept proposed solutions out of deference to scientists and engineers.

Hurricane warnings exemplify the public's tendency to disregard experts' model predictions. Some residents of regions in the path of hurricanes decide at their peril not to evacuate and to ignore weather model predictions, especially if they have survived similar severe events in the past. They mistake their stroke of luck for proof that models exaggerate the risks. Beachfront property sales along coasts around the world continue apace, despite expert analyses predicting sea level rise, the increasing frequency of severe hurricanes, and the threat of tsunamis. In both examples, the members of the public refuse to change their behavior in anticipation of an extreme event. A collaborative planning approach combining expert and local information might be helpful in persuading affected communities to act prudently.

The negotiation field has developed approaches such as joint fact finding, helpful not only for reducing skepticism toward expertise but also for mutual appreciation of all sources and types of knowledge. The value of local knowledge in strengthening urban resilience has been established [42] but remains underappreciated. Joint fact finding entails decision makers and members of the local community working together to formulate questions that are important to all participants, collecting relevant information, and conducting analyses that answer the questions (or commissioning them from sources trusted by all). This approach of co-constructing the information base for public decisions has been shown to reduce judgmental biases and other problems that afflict individual thinking among both lay persons and experts. It can also allay concerns about "advocacy science," or the strategic manipulation of information [4]. Moreover, forthrightness about uncertainty creates a foundation for the need to reconvene and update jointly-developed knowledge if assumptions turn out to be incorrect, or if future conditions diverge from expectations, as they so often do ([4,38,43,44]).

A notable example of the usefulness of joint fact-finding is the adaptive management process developed in the California's Central Valley around the allocation of water amid changing weather patterns affecting surface waters, snow melt and water tables. The objectives of protecting threatened fish species and preserving historical rights of agriculture were in conflict with each other. Representatives from federal and state regulatory agencies, environmental groups and local water utilities formed an "Operations Group" that was charged with gathering and consolidating data from the various group members to build a shared information base on which to make decisions. Later it turned out that a decision to release water into the Delta (based on an assumption of continuing drought conditions) was invalidated by the actual unexpectedly abundant rain events. Since the group had put up its best effort to make decisions based on what they collectively believed was the best information, no stakeholder was inclined to blame others [38]. In general, when groups work together to establish the "facts" or the technical basis for the development of options and decisions for actions—co-constructing their information base—they become willing and able to react constructively when the underlying assumptions (and projections about future conditions) are found to be faulty. The joint recognition of future uncertainties diminishes the impulse to "blame".

Other practices and techniques to defuse the tension between local knowledge and expertise include: regular dissemination of information in highly accessible formats; workshops, panels, simulation games [45] and other opportunities to disclose and explain discretionary elements of research and analysis; public statements by resource managers and elected officials acknowledging the incomplete state of knowledge and the role of surprise; public explanations of discrepancies between different expert advice by resource managers; commitments for ongoing monitoring and data collection and periodic revisiting of decisions [46]. In general, transparency and frequent exchanges of information between all involved in preparing for, or responding to a disaster are a must.

4.4. Developing trust

Working together and building/strengthening relationships and networks to plan and to prepare for disasters requires trust between the public and decision makers. However, trust is fickle, especially relative to institutions rather than the individuals who staff them. Negotiation scholars prescribe, as in the Russian saying popularized by former President Reagan, to "trust, but verify." Collaboration can occur without trust, by carefully constructing a series of contingent or "self-enforcing agreements" [33] in the same manner as lawyers construct contracts which do not require trust between the parties. However, planning scholars advise that "collaboration often ends up building trust nonetheless" ([38], 114). When they interact, individuals come to perceive each other as multi-dimensional, rather than reduced to professional, gender, age or other frames. For example, some hold negative frames about lawyers or business people, or expect women to be easier to negotiate with; person-to-person interactions can counter such frames (e.g. Ref. [47]).

But why leave the development of trust to chance if it is helpful for collaborations? In general, at a micro-level, trust develops over time as participants see in their counterparts four key behaviors: predictability, caring, competency and commitment [48]. Thus, participants in collaborative processes build mutual trust as they see each other predictably following through on tasks from the trivial to the substantial; "caring," defined by mutual understanding of interdependence and experiencing that the selected course of action sufficiently meets each party's interests; competency, evidenced during interactions to devise solutions; and commitment, observed as participants see evidence of follow-up on the agreed-upon alternative to attain shared goals. As interactions become routinized and procedures established, expectations along these four dimensions are met and trust between individuals percolates and transfers to the institutions involved. When a calamitous event strikes—and no amount of science or preparation could account for every situation—the need to trust other individuals and institutions becomes critical for response actions. Hence, consciously creating a pre-disaster structure and patterns of interactions within the entire community (i.e. through collaborative planning) can yield sizable benefits.

5. Conclusions

Why are the responses to the COVID-19 pandemic so rife with examples, many negative, of local reactions to a global catastrophic event? One answer is its salience and reach into everyone's life, with opportunities for all of us to observe its unfolding and consequences daily, with much uncertainty unresolved. Another answer is that in the absence of thorough preparedness in the areas we have discussed, trial-and-error responses had to be devised in the moment, top-down, with no benefit of input from the affected communities, no tailoring to local circumstances, and no safety net or ability to rely on previously developed networks of information exchange and co-generation of solutions. Had it all worked smoothly, it would have cast some doubt on our propositions regarding how participatory preparedness should be conducted to lessen the impact of disasters; as it is, short of a controlled experiment which cannot be undertaken, the numerous failures that beset the COVID-19 response, some of which we mentioned, provide a good measure of support for our prescriptions.

Due to its scale, consequences, and lack of preparedness in some key areas including participatory networks, COVID-19 did not afford decision makers many alternatives outside of reactive recourse to top-down communication and solutions mostly at the federal and state levels. It is at the local level that we can discern some differences in how the public reacted to mandated measures. Some cities and regions benefitted from the public's relationship with authorities, established in other contexts, while others met with resistance and lack of trust. With the luxury of some hindsight afforded by time, we need to understand these local

differences and explore whether they can be accounted for, at least in part, by the existence of earlier positive participatory experiences or lack thereof.

The 2020 COVID-19 pandemic will likely be a source of lessons learned for planners, emergency professionals, government agencies and communities alike. For example, the social distancing practices may redound to other killer epidemics such as the annual flu and new viruses. However, beyond hazard specifics, we need to meet the next “generational gray rhino” by making use of resources and activities already available but not fully tapped. Given the key role of public engagement in preparedness for hazards, we have made the case that combining preparedness activities with routine planning is one approach that can increase the likelihood of readiness to meet the next disaster, whether local, regional, or even global.

Our call for engaging in collaborative planning for preparedness is not new to emergency management. We have elaborated here on why and how it works, why investment in this approach is worthwhile, and perhaps most critically, how to think strategically about one of the most difficult components: public involvement. Conceptually, bringing together planners and emergency response managers has coherence because the “whole community” approach to emergency management mirrors collaborative planning. Therefore, we encourage planners in the fields of land use, infrastructure, transportation, and housing to deliberately include their emergency management colleagues in their design of plans and actions, to harmonize responses to current needs with preparedness for potential future destruction. We also call on emergency management professionals to cooperate with planners and to call on their tools and skills to enhance public participation in preparedness.

Bringing all interested groups into a public participatory strategy to plan emergency responses before an event becomes a disaster has multiple benefits. It educates all community members about potential harms and post-disaster needs, especially in the case of generational gray rhinos⁴; it builds an understanding of interests and priorities of diverse groups; and, it promotes the sharing of information about the capabilities and resources of various groups. Beyond fostering simple awareness of possible conditions after a catastrophic event, the shared understanding of the potential impacts and consequences of a massive event can facilitate the search for creative solutions that address today’s problems while averting dire scenarios of destruction. Including today’s problems in disaster preparedness may remove some of the key obstacles to participatory preparedness.

The future holds a broad range of relatively unpredictable but catastrophic events, or the “unknown unknowns”.⁵ Emergency response is perhaps best thought of as an ongoing task, rather than a one-shot event in reaction to the latest disaster, or the recycling of a script from the last disaster to the next. The lack of political will—among both elected officials and the general public—to invest in preparing for uncertain events can be overcome when members of a community see their current priorities dovetailing actions to mitigate disaster impacts. Co-creating a shared understanding of the community’s resources,

⁴ We know from other disasters such as hurricanes, which hit some regions unpredictably but with high frequency, that such awareness is helpful: in those regions, residents have perfected some preparation strategies that greatly diminish the destructiveness of the hurricanes. Similarly, the frequent earthquakes in Japan have led to sophisticated defensive construction methods that save lives, while earthquakes with the same intensity in other countries make numerous victims. The key in both cases is a thorough knowledge and collective memory of potential damage, which impels people to invest in preparedness.

⁵ Donald Rumsfeld, (the then) US Secretary of Defense, February 12, 2002: ... as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don’t know we don’t know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones.

capabilities and vulnerabilities can also reduce the lack of agreement over problem definition which accompanies “wicked problems.” Working together on routine plans before a disaster occurs helps to build strong relationships and trust among the parties, which will enable the community to respond effectively. It can enhance response flexibility as the uncertainties of the past become present realities.

Including disaster preparedness into routine planning means that stakeholders in collaborative planning also participate in disaster preparedness. Given the inherent uncertainty of sudden calamitous natural and technological hazards, engaging as wide a public as is willing and able to contribute is critical not least because who will be able to respond when necessary is as uncertain as the timing of the event itself. However, managing a process that includes all sectors of a community in disaster preparedness can overwhelm all involved. Therefore, it is necessary to manage sparingly and strategically the precious resource that is the community members’ willingness to participate. We proposed some criteria for selecting which stakeholders are most aptly invited into the various preparedness planning activities depending on the horizon of the decisions at hand.

Collaborative planning concepts, tools and techniques can help overcome the resistance to effective disaster recovery planning and management before an event occurs. It brings together a range of knowledge and skills and helps to generate a collective understanding of the community and its assets. Perhaps most importantly, it can lay the groundwork for solid social relationships and trust among community members and public institutions. Weaving disaster planning into everyday collaborative planning decisions may shore up community resilience.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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