TACTIC

TOOLS, METHODS AND TRAINING FOR COMMUNITIES AND SOCIETY TO BETTER PREPARE FOR A CRISIS

Report on risk perception and preparedness

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Preamble

TACTIC (Tools, methods And training for CommuniTIes and society to better prepare for a Crisis) aims to increase preparedness to large-scale and cross-border disasters amongst communities and societies in Europe. Throughout its two-year duration (May 2014 – April 2016), TACTIC will analyse risk perceptions and behaviour to identify pathways from risk perception to preparedness, and will develop a preparedness audit that communities can use to assess how prepared they are for different types of crises. Additionally, TACTIC will focus on identifying and categorising good practices of communication and education practices for preparedness. The audit, communication and education practices will be discussed and analysed with stakeholders in a series of workshops as part of TACTIC's case studies on four types of crisis: terrorism, floods, epidemics, and earthquakes. Subsequently, a long-term learning framework for improving community preparedness to a range of crisis situations will be developed. All of TACTIC's outputs will be presented in a web-based platform.

This document (This document is a draft version of the literature review which will evolve into the final D1.1 report on risk perception and preparedness.)

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Executive Summary

The overall aim of the TACTIC project is to increase preparedness to large-scale and cross-border disasters amongst communities and societies in Europe. To achieve this, TACTIC considers a range of studies on risk perception and preparedness in order to develop a participatory preparedness audit. The audit aims to enable communities to assess their motivations and capacities with regard to risk communication and education to prepare in a multi-hazard context. This current report presents findings from a literature review on risk perception and preparedness which spans floods, earthquakes, epidemics/pandemics, and terrorism, as well as discussions and feedback from experts in relevant fields. It aims to provide the underpinning evidence base for the project as a whole and as such has been shaped by the specific hazards to be examined and also key components of preparedness identified through an iterative process of literature reviews and discussion with experts.

Risk perception research began with an early focus on understanding why experts and laypeople had such contrasting viewpoints on risk. Why, for example, the layperson was far more fearful of a less likely risk, such as a nuclear meltdown, in comparison to more common risks such as driving. The technical study of risk perception deepened scientific understanding of how factors such as probability, likelihood, magnitude, consequence (e.g. outcome) and aggregation of risks may influence a person's risk perception.

Early hazards research in the 1930s focused on individuals and households and centred on hazard education as a vehicle for risk reduction through preparedness. Increasing a person's knowledge regarding the hazard was assumed central for reducing risk. A paradigm shift in the 1990s towards vulnerability analysis focused more on the social production of risk, asserting that inequalities in exposure to hazards needs to be better accounted for in risk management. In the health sciences, a paradigm shift from a focus on disease diagnosis and identification of risk factors to greater consideration of social and environmental conditions causing disease also occurred in the 1990s. Similarly, many psychological studies shifted from a focus strictly on risk factors to social-psychological and sociological health studies that have focused on the role of emotion, attitude, and beliefs on influencing a person's behaviour, as well as social and environmental factors in general. In concert, each of these different disciplinary perspectives has incorporated risk perception as a research element, oftentimes operationalised in different manners (e.g. as an independent, dependent, mediating variable; as a factor influencing motivation or intention; or questioning the risk landscape itself from a causal perspective). As a result, there is no consensus on the phrase 'risk perception', nor is there a simple answer linking risk perception to preparedness behaviour and no singular perspective or scale from which preparedness is viewed.

Three general conceptualisations of risk emerge from the literature with practical applications for preparedness which we are calling 'realist,' 'constructivist' and 'critical'. "The realist approach assumes risk is objective and measurable and aims to bring perception as close as possible to the objective risk of an activity or event (Rosa, 1998; Rosa, 2008). The solutions to problems of perception are then simply ones of more information and a greater understanding of the risk. The risk itself is not questioned. But are likelihoods or even probabilities real phenomena? Constructivists argue that risk is not objective but subjective and socially constructed (Jasanoff, 1998; Wachinger and Renn, 2010: 8). Thus, these two approaches offer us, not just two broad ways of understanding the perception of

risk but also two broad approaches to facilitating effective behavioural responses (these are not watertight, discrete approaches but simplified heuristics to inform practical interventions). In the first, realist approach, poor risk perception is potentially assisted through the provision of appropriately targeted, constructed and delivered information. In the second, constructivist approach, a lack of preparedness behaviour may be the result of a denial of the particular framing of risk by some groups and individuals; awareness and inclusion of a range of perspectives within any community can promote greater levels of acceptance and motivation to act.

However, a problem arises because of the dearth of studies that directly link perception with behavioural response in the specific context of preparedness. Furthermore, there may still be a lack of preparedness behaviour despite high risk perception if people lack the resources to act. A third approach considers barriers to preparedness which arise from structural processes in societies. What we are calling a 'critical' approach is characterised by an objective to understand the root causes of risk, commonly across different levels of society. These studies typically provide a materialist political examination of risk societies including inequalities across different social groups. The implication of this approach is that effective intervention may be required at the societal and political level rather than the individual and psychological. For example, Comfort et al. (1999) recommend the following measures are needed to address socially constructed disaster risk: the development of an interdisciplinary "vulnerability index" to provide a reliable measure of differences among communities that are exposed to a similar range of hazards; a 'multi-way' information exchange system to enable communities to better coordinate and share information; enabling local, community-level initiatives to reduce vulnerability through training, capacity building and resource transfers; developing maps of decision processes for disaster preparedness that identify critical actors at different decision-making levels, as well as their roles and responsibilities; and enabling affected populations with risk management (43-44). In this approach, risk perception is but one aspect that can lead to preparedness behaviour; people also require the resources to act. Drawing together conclusions from studies across these different disciplinary perspectives therefore enables a better understanding of pathways from risk perception to preparedness, as well as potential obstacles to preparedness.

The findings of this report highlight advantages of different disciplinary approaches for informing preparedness; some are well suited to risk assessment and others for informing risk management and preparedness. Rapid response to all of the hazards examined requires identification and monitoring of risk factors, however the diversity of personal, social, and environmental consequences that can emerge from different hazard types requires different resources, or different allocations of resources, which tend to require a risk management perspective. An 'all-hazards' approach should be underpinned by a combination of theoretical approaches spanning the realist, constructivist and critical, to address different facets of hazard risk.

Building on recent work on risk perception and natural hazards in the European context, and an expert workshop in Krakow Poland (Begg et al., 2014; http://www.tacticproject.eu/workshops) where the characteristics of preparedness were further discussed in light of their practicality for a community level audit, a set of components of preparedness were identified as: 'information/knowledge', 'motivation', 'networks', 'responsibilities' and 'resources' were identified as the revised components. The components of preparedness are thus defined from the literature and

practical experience of experts to consider a range of personal, social, cultural, and environmental factors or processes that can impact ability to prepare at an individual, community or organisational or governmental and administrative levels. A preparedness typology is presented that summarises key findings of the report and enables discussion of the roles and responsibilities of different actors for a multi-hazard context. An initial set of questions has been prepared for the audit to reflect the main findings from the current review and workshop activities for addressing these factors or processes. The preparedness audit will be tested in community workshops in England, Germany, Poland and Turkey. Those workshop results will be used to further inform and revise the audit before the audit is extended into an online learning platform (work package two and nine; http://www.tacticproject.eu/the-project).

1. Introduction

The overall objective of work package one (WP1) is to identify pathways from risk perception to preparedness. Therefore WP1 focuses on risk perception and behaviour and identifies factors that lead to a better understanding of whether risk perception affects individual preparedness actions. More specifically, this WP pursues this objective by:

- Developing a definition of preparedness which is agreed upon by the consortium (Task 1.1)
- Developing a preparedness typology: this will be achieved by identifying and understanding the perceived and legal roles, responsibilities and types of action taken by different actors (e.g. individuals, organisations and responsible authorities) in relation to preparedness. This information will include a range of hazards, including large scale and cross-border hazards/disasters as well as take into account their cascading effects (Task 1.2)
- Identifying factors (e.g. cultural and individual) that influence and define how individuals perceive and are aware of risks and, in addition, how these factors influence and define behavioural responses to, and responses for, risk and emergencies as well as the current level of individual/community preparedness within a given community; and
- Better understanding the impacts and effects of preparedness activities which can be taken by individuals, organisations and responsible authorities with regard to different crisis and disaster scenarios (including short- and long-term scenarios) (Task 1.3)

1.1 Defining preparedness

In order to develop a clear and agreed upon definition of what preparedness entails and to therefore strengthen the objectives of the project as a whole, it is important to conduct a review of how preparedness as a concept is used in theory and practice.

Preparedness is a term that could easily be defined with one word, 'readiness', or a simple phrase, 'the state of being prepared,' but which prompts a multitude of different meanings when contextualised for a specific type of event. As the frequency and cost of disasters continues to rise on a global scale, many initiatives have arisen engaging the question of how to best prepare for hazards, as poor hazard preparation often leads to disasters. The Hyogo Framework for Action (HFA), for instance, is an example of an international initiative aimed at reducing the risk from natural hazards. Strengthening preparedness is listed as Priority Action 5 of HFA. More generally, as risk management policy and strategy have evolved, so too has the consideration of what hazards to plan for. Some European nations, for example, have adopted a broader 'all-hazards' planning approach that incorporates natural hazards, public health hazards such as epidemics or pandemics, and other human-made hazards such as terrorism. One example is the United Kingdom's (UK) National Risk Register (https://www.gov.uk/government/collections/national-risk-register-of-civil-emergencies), which reports the results of regular analyses of the threat of natural and human-made hazards such as terrorism to the UK to assist individual citizens and communities with preparedness (Cabinet Office, 2013). The National Security Risk Assessment (NSRA) (http://www.parliament.uk), an analytical component of the NRR, ranks natural hazards and international terrorism affecting the UK or its interests as the highest priority, or Tier 1, risks (Cabinet Office, 2013). Additionally, many national and

international organisations such as the National Health Service in the UK, the World Health Organisation (WHO), and US Centers for Disease Control (CDC) and the United Nations (UN) internationally, incorporate policy and planning initiatives focused on preparedness for public health. For example, the WHO hosts the Pandemic Influenza Preparedness (PIP) framework (http://www.who.int/influenza/pip/en/), which aims at bringing together different stakeholders internationally to increase preparedness and response to pandemic influenza (WHO, 2011).

As a starting point, TACTIC adopts the UN's Office for Disaster Risk Reduction (UNISDR) definition of preparedness:

> "The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions." (UNISDR, 2007)

UNISDR's definition of preparedness reflects key concepts such as knowledge, capacities, and levels of action and interaction, e.g. between individuals, communities, organisations, and governments, that have been found to be influential by disaster researchers and practitioners as evidenced in the scientific literature (to be discussed below). Additionally, the UNISDR definition is globally recognized and commonly referenced in international policy documents.

1.2 Preparedness as a phase in the disaster cycle

Preparedness today is commonly recognized as one of the disaster phases (e.g. mitigation, preparedness, response, and recovery) that forms a part of the disaster management cycle, which has been used by practitioners and researchers since the 1970s for planning and analysis (Neal, 1997; Coetzee and van Nierkerk, 2012). For instance, the UN defines the disaster management cycle as the complete set of phases related to disasters and their management (prevention, mitigation, preparedness, response, rehabilitation, reconstruction and recovery).

The term preparedness, however, has not always been specifically utilized for disaster management, nor does it have a clear or concise definition. Very frequently, in fact, preparedness is not explicitly defined but implied or embedded within disaster risk reduction (DRR) or Disaster Risk Management (DRM) definitions. The Intergovernmental Panel on Climate Change (IPCC), for example, mentions preparedness within definitions of DRR and DRM, but does not explicitly define the term preparedness (IPCC, 2012).

Table 1 (below) describes changes in the disaster phases. As early as the 1920s phases of disasters were being described by scholars and practitioners engaged in humanitarian response and disaster management, but it wasn't until the 1970s when preparedness emerged as a phase referring to the time before a disaster occurred (Neal, 1997; Coetzee and van Nierkerk, 2012). Barton (1969) mentions, but does not detail, a pre-disaster period. Mileti, Drabek and Haas (1975) group the terms preparedness and adjustment together as the first disaster phase, but also include warning and pre-impact early actions as the second and third phases, respectively; actions which are frequently implied in today's usage of preparedness. The US National Governor's Association (1978) further

distinguishes between the terms mitigation and preparedness, with mitigation actions occurring when a hazard threat is not imminent and refer to actions taken to prevent or lessen the impacts of a potential hazard, whereas preparedness 'fills in' when the hazard threat is imminent.

Preparedness actions under this classification, for example, might include moving furniture upstairs, or placing sandbags to protect property when a flood warning has been issued. Finally, the ordering of preparedness is again shifted in Fothergill's (1998) eight-phase typology, where risk perception is ordered as the first phase, which is then followed by a joint grouping of preparedness and mitigation.

Table 1: Examples of changes in the theoretical conceptualization of disaster phases.

Source	Description	Disaster phases
Prince, 1920	Established that societal response and change following a disaster could be described in phases.	1. Emergency period (confusion and general panic with affected population), 2. Transition period (organized groups quickly respond to disaster impacts and begin search and rescue efforts), 3. Rehabilitation period (aims at social reorganization to restore normal ways of life, e.g. recognition that relief efforts only serve as a temporary alleviation for social/economic losses, thus further planning is needed to fully recover).
Carr, 1932	Early definitions of disaster phases	1. Preliminary or prodomal (the forces that will ultimately cause the (cultural) collapse are getting underway), 2. Dislocation and disorganization (deaths, injuries, and other losses that follow the event), 3. Readjustment and reorganization (first attempts of the community to respond to disaster; characterized largely by the culture, morale, leadership, as well as the nature of the disaster impacts), 4. Confusion and delay (time between catastrophe and emergency plans begin operation)
Powell, 1954	Describes eight disaster phases	1. Pre-disaster conditions (communities' familiarity/attitude towards a hazard), 2. Warning (precautionary activity), 3. Threat (actions related to surviving the impact), 4. Impact (an individual's developing perception that the community may be devastated), 5. Inventory (individual/community fully realize the degree of impact), 6. Rescue (the emergent, ad hoc efforts to rescue victims), 7. Remedy (occurs when trained, professional emergency managers arrive on-site), 8. recovery (attempts to resume normal operations)
Chapman, 1962	Describes six disaster phases	1. Warning (search for certainty in the absence of information) 2. Threat (threat is faced more directly than in the warning phase), 3. Impact (period when disaster strikes causing loss), 4. Inventory (aimed at understanding the damage and informal rescue efforts), 5. Rescue (convergence behaviour brings together different actors to respond more formally), 6. Remedy (relief starts to flow into the community)
Stoddard, 1968	Describes seven disaster phases	1. Pre-emergency (not described), 2. Emergency spans (3. warning, 4. threat and evacuation 5. dislocation, 6. relocation), 7. Post-emergency (short-term and long-term relocation)
Barton, 1969	Function and temporal considerations associated with disasters	1. Pre-disaster period (not described), 2. Time of detection and communication of warning for a specific threat, 3. Immediate (or unorganized) response, 4. Organized-social response (could last days, weeks, or years), 5. long-run, post-disaster equilibrium (effected unit readjusts from the disaster)
Dynes, 1970	Temporal classification for the purposes of codification	1. "Before," 2. "During," and 3. "After" a disaster strikes
Baird et al., 1975	Six phases	1. Reconstruction, 2. Mitigation and prevention, 3. Preparedness for relief, 4. Warning, 5. Relief, 6. Rehabilitation.
Mileti, Drabek and Haas, 1975	Synthesizes 191 articles, books & papers on disasters	1. Preparedness/adjustment, 2. Warning, 3. Pre-impact, early actions, 4. Post-impact, short-term actions, 5. Relief or restoration, and 6. Reconstruction
National Governor's Association Report, 1978	Geared at disaster managers	1. Mitigation (the initial phase that occurs earliest before a disaster; pertains to efforts to lessen or eliminate the effects of a disaster), 2. Preparedness (relates to events closest to an actual disaster; "fills in" where mitigation cannot reduce the effects of a disaster, includes categories of planning and warning), 3. Response (occurs right after the disaster), 4. Recovery (focus on efforts to bring

		area back to its normal or predisaster state)
Fothergill, Maestas and Darlington, 1999	Eight-category typology based on the stages of a disaster event	1. Risk perception (how people viewed risks and threats of disasters); 2. Preparedness (all pre-event preparation activities and mitigation efforts in advance of a specific warning); 3. Warning communication and response (entails receiving warnings and taking some type of action in response to this warning); 4. Physical impacts (the actual and immediate effects of the disaster); 5. Psychological impacts (the emotional stress, trauma and other psychological impacts of a disaster event); 6. Emergency response (the post-impact period); 7. Recovery (one-year period following a disaster), 8. Reconstruction (long-term restoration).

As Table 1 illustrates, preparedness was not considered a phase prior to the 1970s, it is not always defined explicitly, nor does it appear consistently in the same order within the phases, and it is commonly grouped with other terms such as adjustment and mitigation. The simple explanation is that ideas regarding preparedness have been influenced by the many different disciplines engaged in disasters research such as engineering sciences, sociology, geography, civil defence, and many others. Adding complexity, similar to preparedness, the terms it is frequently paired with such as adjustment and mitigation, do not have concise definitions. In addition these terms (e.g. preparedness, mitigation, and adjustment) have different ascribed meanings for different hazard types. The term adjustment commonly refers to structural measures, typically grouped under the category 'mitigation', but frequently considered 'preparedness and mitigation' (White, 1974, pp 3-16). The term adjustment is commonly used when studying floods, earthquakes, or when discussing civil infrastructure for counter-terrorism. Flood adjustments, for instance, may entail raising ones' house, constructing a flood wall, installing dikes or levees, or other actions intended to prevent or mitigate a potential flood threat. Common examples of adjustments for earthquakes include securing furniture and bookshelves, to building with earthquake resistant materials and complying with building codes and regulations meant to reduce risk. Other activities such as stockpiling food, medicine and emergency resources, making copies of important documents, creating an emergency plan, purchasing insurance, are often referenced as preparedness, mitigation, or adjustment actions. Additionally, preparedness/mitigation are often used interchangeably or grouped together, but generally, mitigation refers to actions taken when hazard threat is not imminent (e.g. passive protections) and preparedness is considered when the hazard threat is imminent (e.g. active actions) (Sutton and Tierney, 2006).

It is also worth noting that the range of activities presented as adjustments are frequently influenced by disciplinary perspective, e.g. traditionally geographers researched 'hazards', focusing more on the natural or physical aspects of hazard events, and sociologists researched 'disasters', focusing more on the social impacts (White, Kates and Burton, 2001). The term adjustment can refer to activities involving both physical and social resources, however traditionally the use of the term adjustment has been more common in the hazards community whereas the disasters community refers to typically more social measures around 'disaster risk reduction (DRR)' activities. Over recent decades, there has been a shift in the academic research community toward the 'disasters' view (White, Kates, and Burton, 2001), thus one effect may be cross-pollination and evolution of preparedness terminology as different disciplinary perspectives interact.

Finally, we must acknowledge the critique of linearity and sequencing that the disaster cycle/phases suggests. Von Kotze and Holloway's (1996) alternative Expand-Stretch model (pages 33 and 37) identifies the different components but argues that they can, and are carried out concurrently albeit with different emphases. This version neatly sidesteps the problem inherent in the cycle that suggests people and communities are locked into a system inevitably leading to repeat events; it also provides a continuity alternative to the more typical discrete stages, activities, and involved actors which can lead to a lack of connection between the system parts.

1.3 Risk perception and preparedness

The psychometric paradigm provided the early foundation for risk perception research with the aim of understanding how people form judgments about risk and why these judgments frequently vary from those of experts, that is, mapping the intuitive 'rules of thumb' or heuristics which people use to form their judgements about the meaning and severity of the risks they face (Fischoff et al., 1978, 1981, 1984; Slovic, 1987; Gardner and Gould, 1989; Fife-Schaw and Rowe, 1996; Wilkinson, 2001). The technical study of risk perception deepened scientific understanding of how factors such as probability, likelihood, magnitude, consequence (e.g. outcome) and aggregation of risks may influence a person's risk perception.

The harshest critiques of risk perception research have emerged predominantly from the field of sociology (Table 2). Criticisms relate primarily to assumptions made when extending psychological tests of risk perception completed in a laboratory setting to the 'real world' setting. For instance, early critiques of the psychometric paradigm pertained primarily to the focus on the individual without consideration of social, environmental, economic, or cultural factors that could also influence a person's perspective on risk. Changes to the study of risk perception, more specifically, to better contextualising how to apply knowledge about how people process risk in a social context, have been both epistemological and ontological in nature. For instance, both qualitative and quantitative methods are frequently employed in current risk perception research, which better enables researchers to address issues such as potentially introducing bias. Social-psychological research is addressing, among other concerns, the linkage between cognition, social factors and behaviour. Conceptually, new frameworks have emerged that recognise the complexity of the potential social, environmental, and cultural processes that may influence people's interpretation and response to risk across various levels of society. The social amplification of risk framework, for instance, conceptualizes risk partly as a social construct and partly as an objective property of a hazard or event (Renn, 2008). There is also recognition of the need to better integrate vulnerability analyses with risk perception studies (Wachinger and Renn, 2010), which essentially facilitates analysis of the heterogeneity of risk for different individuals and groups.

Table 2: Critiques and progress of risk perception research over recent decades.

Citations	Key critiques	Response and changes in risk perception research
Starr (1969); Wilkinson (2001)	Distinguished between voluntary and involuntary exposures to risk as an important determinant for how people weigh the social costs and social benefits of technological advances.	Risk perception researchers expanded the variables examined that might influence people's perception of different types of hazards, e.g. Slovic (1987) shows laypeople are more influenced by the social meaning associated to nuclear power, rather than by results conveyed from scientific analyses of nuclear power risk.
Freudenberg and Pastor (1992); Lupton (1999); Wilkinson (2001)	Raised concern regarding the politicization of risk perception research, e.g. many risk perception researchers addressed risk from a 'realist' perspective, assuming risks were objective and disregarding the potential for social construction of risk according to the institutional bias of governments and industry experts (Lupton, 1999; Wilkinson, 2010).	Greater awareness and discussion of potential for risk perception research to be politicized within the research community.
Cutter (1993); Wilkinson (2001)	Raised concerns over the scale of risk perception research, which tends to focus on individuals irrespective of their social environments.	Socio-demographic variables are examined in the majority of risk perception studies today. However, understanding the linkages between these variables and risk perception remains a challenge, but one that is acknowledged and continues to be addressed as research progresses.
Cutter et al (1992); Gustafson (1998); Wilkinson (2001)	Raised concerns regarding the potential bias imposed by research methods, e.g. qualitative analyses suggested significant gender differences in regards to health and environmental risks (Cutter et al., 1992; Gustafson, 1998; Wilkinson, 1999) that did not emerge from more traditional quantitative risk	Today there is greater acknowledgement that different methodological approaches may result in quite contradictory viewpoints (Gustafson, 1998; Wilkinson, 2010). Many risk perception studies today incorporate both qualitative and quantitative methodological elements.

	perception approaches.	
Coleman (1993); Gustafson (1998); Sjöberg (1998); Wilkinson (2001)	Some risk perception research has equated cognitive judgments with emotional responses. However, there is no necessary relationship between cognitive judgments and emotional states (Sjöberg, 1998; Wilkinson, 2010).	Social-psychological studies have emerged that incorporate risk perception as a factor in models describing relationships between social factors and cognition (Paton et al., 2003), as well as other psychological models aimed at linking risk perception and preparedness behaviour (Joffe, Rossetto, and Adams, 2013).
Rogers (1997); Bellaby (1990); Irwin et al. (1999); Kasperson and Kasperson (1996); Wilkinson (2001)	Risk perception studies may capture a snapshot of an individual's risk perceptions, as these perceptions may change with age, experience, social context, or as people interact with different social groups/settings. There is not necessarily a correlation between what is recorded on a questionnaire and how people respond to risk in a social context.	The social amplification of risk framework was developed to address shortcomings of the psychometric paradigm and cultural theory (Renn, 2008). Social amplification of risk is based on the idea that the 'social and economic impacts of an adverse events are determined by a combination of direct physical consequences interacting with psychological, social, institutional, and cultural processes' (Kasperson et al. 1988, Renn, 1991, Kasperson et al. 2003, Breakwell 2007; Renn, 2008).

As the study of 'risk perception' has emerged and changed across many different disciplines, there is no consensus on an explicit definition for the phrase (Wilkinson, 2001). This is not uncommon for high priority research agendas; for instance, the same is true for 'risk', 'vulnerability', and 'resilience'. There is widespread recognition in the risk perception research community that social, environmental, and cultural factors and processes can influence risk perception at a variety of scales. The literature review section of this report draws together key findings from several different disciplines engaged in risk perception research for floods, earthquakes, epidemics/pandemics, and terrorism. While no single disciplinary approach exists that can thoroughly map the complex pathways between risk perception and preparedness action this review identifies key disciplinary approaches and important findings to enable this analysis.

2. Literature review

2.1 Risk perception and its effects on behaviour and preparedness actions

The body of peer-reviewed academic literature on risk perception and preparedness is quite diverse owing to a number of factors such as different ontological beliefs driving the framing of research and numerous epistemological approaches toward research design and analysis. In concert, risk itself is dynamic and is continually changing as hazards, vulnerabilities, and perceptions of what is a reasonable or acceptable level of risk change across the diversity of actors involved. From a pragmatic perspective, this poses significant challenges for stakeholders engaged in the practise of disaster risk reduction across different levels of society. For instance, an emergency manager may require information on physical risk posed by the hazard, behavioural response of community members and emergency personnel to different hazard risks, resources required to address these risks, as well as the heterogeneity of risk across the community as a combination of these factors.

No single theory or disciplinary approach provides an answer to support preparedness needs. Engineering and physical hazards studies have provided a strong knowledge base of the physical systems processes, and scientific and technological advances continue to improve our capabilities to predict the onset of certain types of hazards, as well as the measurement of potential physical impacts. Psychological approaches have helped to understand how individuals process different types of risk. Social-psychological studies have helped to understand how social factors, attitudes, and norms influence individuals' abilities and motivations for preparedness. Disaster sociology studies have focused on how different social groups and collectivities experience disasters and why this is not homogenous across hazard type, geography, community or society. Indeed, the foregoing is an oversimplification as there is much crossover in the agendas, interpretations and achievements of these different disciplines, as well as the many other disciplines (see Alexander 1997 where some 30 disciplines are acknowledged as being concerned with the study of disasters), which engage in preparedness, related research.

One objective for TACTIC is to review the broad literature on risk perception and preparedness to better clarify what is known about how people prepare for different types of hazards and what challenges

emerge for preparedness. Another is to draw on that knowledge to inform the construction of the preparedness audit which must communicate beyond the academy. A diverse base of literature is reviewed here that is not traditionally examined in concert, as many studies are typically grounded in disciplinary findings from just one or two different disciplines or approaches. In an effort to assist readers with framing the results of the preparedness literature review a general simplification of the diversity of disciplinary approaches and their implications for practice is provided, developed from a schema used in the CapHaz-Net Project:

> "There are two main approaches to the study of risk perception, the realist approach and the constructivist approach (Renn, 2008: 2). The realist approach to risk could be described as aiming 'to bring perception as close as possible to the objective risk of an activity or an event'. It assumes that there is an outside objective world with risks that we can recognize and acknowledge (Rosa, 1998; Rosa, 2008). The solutions to problems of perception are then simply ones of more information and a greater understanding of the risk. The risk itself is not questioned. But are likelihoods or even probabilities real phenomena? Constructivists argue that risk is not objective but that they [*sic*] are subjective and socially constructed (Jasanoff, 1998)." (Wachinger and Renn 2010: 8)

Thus, these two approaches offer us, not just two broad ways of understanding the perception of risk but also two broad approaches to facilitating effective behavioural responses (these are not watertight, discrete approaches but simplified heuristics to inform practical interventions). In the first, realist approach, poor risk perception is potentially assisted through the provision of appropriately targeted and constructed information. In the second, constructivist approach, a lack of preparedness behaviour may be the result of a denial of the particular framing of risk by some groups and individuals; awareness and inclusion of a range of perspectives within any community can promote greater levels of acceptance and motivation to act.

However, a problem (discussed further below) arises because of the dearth of studies that directly link perception with behavioural response in the specific context of preparedness. Furthermore, there may still be a lack of preparedness behaviour despite high risk perception if people lack the resources to act. A third approach considers barriers to preparedness, which arises from structural processes in societies.

What we are calling a *'critical' approach* is characterised by an objective to understand the root causes of risk, commonly across different levels of society. These studies typically provide a materialist political examination of risk societies including inequalities across different social groups. The implication of this approach is that effective intervention is required at the societal and political level rather than the individual and psychological. In this approach, risk perception is but one aspect that might lead to preparedness behaviour; people also require the resources to act.

2.2 Structure of the literature review

This review is structured such that each of the hazard types examined (floods, earthquakes, epidemics/pandemics, terrorism) is examined in a separate chapter. At the beginning of each section a brief introduction is provided giving an overview of hazard impacts in the EU and describing the general structure of the risk perception and preparedness literature for that hazard type. Detailed discussion and summary of the factors influencing preparedness behaviour follow the introduction. Additionally, case studies are provided to elaborate on different elements of preparedness findings. The second section of each chapter provides an overview of preparedness in practice, that is, an examination of the roles and responsibilities of different stakeholders. This section cannot be comprehensive, rather, it is meant to be illustrative with regards to drawing out additional preparedness concerns from the literature to inform the preparedness audit. Finally, a typology is presented based on literature review findings and additional review advised by experts, which addresses preparedness from a multi-hazard and multi-stakeholder perspective by identifying the perceived and legal roles, responsibilities and types of action taken by different actors (e.g. individuals, organisations and responsible authorities) in relation to preparedness.

2.3 Search approach and eligibility criteria

Web of Science and Google Scholar databases were searched using the keywords “risk perception, preparedness, behaviour, hazard, disaster, crisis, flood, earthquake, epidemic, pandemic, animal disease, terrorism, and communities.” Forward searching of the identified references was also carried out. References were obtained from TACTIC’s expert panel http://www.tacticproject.eu/. Papers were included if they met the following eligibility criteria: (i) hazard type: included one or more of the hazard types investigated in the TACTIC project (flood, earthquake, epidemic/pandemic, terrorism); (ii) reported on associations between the research variables 'risk, risk perception, behaviour, or preparedness' with one or more of the hazards identified; (iii) preference was given to literature reviews or meta-analyses or (iv) studies which specifically address limitations identified through discussion (e.g. communication focused) with the expert panel, or throughout the course of the literature review.

3. Risk Perception and Preparedness: Floods

The following section discusses risk perception and flood hazards. Of the hazard types examined here (e.g. floods, earthquakes, epidemics/pandemics, terrorism) risk perception studies for floods are the most common in the scientific literature, especially for the European context. This is in part because flooding and storms were the most expensive natural hazard in Europe for the period 1999-2008 with costs reaching approximately EUR 52 billion (MunichRe, 2014). More recently, flooding in southern and eastern Germany and neighbouring states in June of 2013 has been the costliest natural hazard of the year with overall losses estimated at EUR 11.7 billion and insured losses at EUR 2.3 billion (MunichRe, 2014). Thus, flood hazards have received a significant focus in the preparedness literature. Therefore this section examines flood risk perception studies exclusively in the European context.

3.1 Key points for researchers and practitioners: floods

Knowledge/information

Key findings

- Actual risk area is correlated to risk perception in some studies. Risk perception varies more dramatically in flood studies compared to other hazards
- Information on cause of the hazard was found in some studies to benefit risk perception and preparedness
- Lack of knowledge of private precautionary measures/benefits found in some studies
- Many studies consider 'prior experience' with flooding a factor influencing risk perception and results are 'mixed' as a variety of intervening variables have been recommended such as personal losses incurred during the experience, or time since the event. Therefore, prior experience can have variable effects on risk perception and preparedness, e.g. it can improve or decrease preparedness
- Lack of awareness of legal roles and responsibilities for preparedness found in some studies at the individual/household scale. Changing roles for certain landowners and businesses identified at the local scale.
- Some studies recommend that people's knowledge/information regarding different types of flood hazards varies broadly, e.g. more knowledge or river floods versus groundwater floods
- Overall, risk perception of floods varied quite broadly within the EU context

Key gaps

- More evaluation of needs and perceptions for different flood types (e.g. coastal, groundwater, river, urban) for different stakeholders
- Absence of discussion of business/livelihood continuity plans. This applies to other hazard types as well.
- More transparent & systematic monitoring of the following factors needed for information systems:
- Changes in environmental and social exposure to flood risk
- Downstream and cascading effects
- Needs to be 'multi-directional' transfer of information
- Frameworks have been established to enable mapping legal roles and responsibilities under changing risk governance landscapes; however there is a need to extend these studies for the

Motivation

Key findings

- Many studies in the EU context have found that risk perception is highly variable.
- Trust in local authorities, positive identification with place, observing others adopting preparedness actions and problem-based coping have been found in some studies to positively impact preparedness.
- Some studies found that risk area or 'actual (physical) risk' was correlated to risk perception, e.g. people living in the floodplain or in low-lying regions had a better understanding of their flood risk. However, this knowledge did not always lead to preparedness actions.
- Societies favouring collective action tend to prefer government intervention for mitigation/preparedness.
- Studies in the EU have shown citizens often prefer publicly funded mitigation measures and may not recognise their legal obligations related to preparedness.
- Many studies recommend greater time in residence and prior flood experience can positively impact preparedness. However, other factors such as demographic variables can intervene.
- Many studies recommend that risk perception changes after a flood hazard event.
- Many studies have found gender differences in the types of preparedness activities people engage in and the value these activities are assigned within different communities; this can present obstacles to preparedness.
- Many studies have shown women tend to have higher risk perception, take hazard warnings more seriously and comply with evacuation warnings

Key gaps

- What motivates communities versus individuals, e.g. most studies focus on individuals/household level and the motivations for preparedness may differ at the community level. This applies to other hazards types as well.
- More work is needed on intangible impacts of flooding and how to plan for via preparedness measures. This could be better informed by the social-psychological literature on earthquakes.

Networks

Key findings

- Women are underrepresented in formal emergency planning agencies in many countries.
- Networks did not emerge as a strong focus in flood risk perception studies. Indirectly, some studies implied the importance of social networks or community ties as imbuing better knowledge and information for hazard preparation.
- Some studies found a positive relationship between social involvement in the local community and willingness to take preparedness actions.

Key gaps

- Absence in the preparedness literature pertaining to motivation and maintenance for various types of networks and how this impacts preparedness. This applies to other hazard types as well.
- The legal roles and responsibilities for different organisations/institutions for preparedness are not always clearly defined. This is an issue that requires further analysis across hazard types.

Responsibilities

Key findings

- Many studies have shown households with children or dependents are more likely to take certain preparedness actions.
- Several studies highlight disagreement regarding the trend toward privatisation of flood risk and the associated gain in risk responsibility at the individual/community level.
- Some countries have shifted greater flood risk management responsibilities onto citizens with little to no legislative changes.
- Some studies explored people's preferences for different types of flood defences (e.g. structural, typically government funded measures versus private precautionary measures, funded by individuals) finding a preference for public flood defences such as dikes or levees
- Some studies explored citizen's knowledge of their legal responsibilities for private precautionary measures, finding many were unaware of their obligations.

Key gaps

- An obvious gap in studies related to local actor responsibility is questioning the role of flood insurance, e.g. citizens may choose not to invest additional money in preparedness measures when they have flood insurance, which will cover the cost of flood damage.
- Flood risk management has been decentralised for many countries, yet there is a lack of analysis regarding citizens' ability to effectively cope with this risk. The same applies for other hazard types.
- Another research gap pertains to 'downstream effects', e.g. precautionary measures taken upstream can exacerbate flooding impacts downstream.

Resources

Key findings

- Some studies recommend social class is a strong predictor of flood risk awareness.
- Some studies have found that lack of resources and mistrust in authorities promotes non-adaptive behaviour.

Key gaps

- General lack of focus on specific intervention strategies and effectiveness for capacity building in the preparedness literature across hazard types.
- Lack of analysis for how to enable communities to engage in and promote land use based (e.g. natural defence) protective measures, which may also positively influence health and wellbeing (e.g. other bodies of literature have recommended positive impacts of green space/natural environments on well-being). This applies to other hazard types as well.
- Lack of analysis regarding capacity building across personal, family, neighbourhood, community and societal scales. This applies to other hazards as well.

In order to explore linkages between risk perception, behaviour and preparedness for floods, information was collated from recent and extensive literature reviews focused on risk perception and natural hazards. The first review by Kellens, Terpstra and De Maeyer (2013) investigates risk perception and floods paying special attention to the topic of communication. Kellens, Terpstra and De Maeyer (2013) applied the following selection criteria: i) the work is peer-reviewed in an international journal; ii) is based on empirical data relating to citizens directly, or at least in part; iii) the research is applied to flood risk in general or a specific type of flood risk (e.g. flash flood, coastal flood, river flood, etc.); iv) the public perception of, or the public attitude toward, flood risks is measured either qualitatively or quantitatively, or v) specific focus is given to the communication of these flood risks. The second study is a literature review by Wachinger and Renn (2010) examining risk perception and natural hazards in the European context. The third review by Wachinger, Renn, Begg and Kuhlicke (2013) is an extension of the Wachinger and Renn (2010) work, which adds additional natural hazard case studies in the European context and focuses more explicitly on specific factors that may influence public risk perception of natural hazards. These three reviews were selected as they offer the best representation of flood risk perception studies for the EU context. Comparing these reviews with the additional keyword search results, it was clear that they spanned the majority of the flood risk perception studies currently available in the literature for Europe. However, a few additional studies were added from technical reports resulting from European flood risk projects.

Table 3 is adapted after Kellens, Terpstra and De Maeyer (2013), which is a summary table of the flood risk perception studies reviewed. Kellens, Terpstra and De Maeyer (2013) adopt the method of Lindell

and Perry (2004) for classifying adaptive measures according to the phases of the hazard lifecycle: (1) mitigation, (2) preparedness, and (3) recovery. Preparedness here is distinguished as actions taken when the threat of a hazard is imminent (e.g. moving sandbags in front of households just prior to a flood; moving furniture within the house to avoid flood damage; evacuating to emergency shelters or to higher ground, etc.) or 'last call safety measures.' Thus, the adaptive measures taken when flood threat is not imminent are considered mitigation measures (e.g. raising one's home above the height of flood level). Recovery measures refer to those that help people return to a 'normal' state such as government aid or flood insurance. Flood insurance is considered by many to also be a mitigation measure, so it is identified separate from the mitigation category as well. As the focus of this current review is to identify factors related specifically to preparedness, the method of Lindell and Perry (2004) for categorizing preparedness actions is adopted and additional flood risk studies identified in by Wachinger and Renn (2010) and Wachinger, Renn, Begg and Kuhlicke (2013) are evaluated based on the same criteria and added to Table 3. These include results from European Union funded projects, some of which were published as technical articles, which is why they were not included in the results from Kellens, Terpstra and De Maeyer (2013). However, these studies were internally reviewed by experts and resulted in later academic publications that were peer-reviewed around or after the time of the Kellens, Terpstra and De Maeyer (2013) publication.

While it is not feasible to directly compare flood risk perception studies for numerous reasons, predominantly because of differences in research design, grouping studies by the behavioural categories examined (e.g. preparedness, mitigation, recovery) and then summarizing key factors identified allows for a discussion of important factors for flood risk perception and preparedness. The following classification scheme is used to aggregate similar variables to focus the discussion of key factors in the following section, as these themes most commonly emerged from the literature.

- Emotion: refers to both positive and negative affect, worry, anxiety, or other emotions as noted in the studies reviewed
- Experience: refers to direct personal experience with a flood; indirect experience is also noted
- Knowledge: refers to different types of knowledge, including local, scientific or technical (information on protective measures, private precautionary actions, evacuation plans, etc.) or other knowledge of the hazard (e.g. cause, likelihood, etc.)
- Responsibility: refers to discussions of which actors are responsible for mitigation measures or protective actions
- Risk area: refers to the geographical characteristics of the hazard area, e.g. proximity to a flood plain or structural defences, elevation, etc. This is also referred to as 'actual' risk in some studies.
- Time in residence: refers to residents' tenure in the risk area
- Other: other variables that did not occur as frequently, listed as they are detailed in the studies

Emotion, experience and knowledge were the most commonly cited factors influencing flood risk perception and behaviour (Table 3). Very few studies examined preparedness behaviours explicitly, thus those examining both preparedness and mitigation are shown in Table 2. More studies examined mitigation solely, as are shown in Table 3. No studies reviewed here focused on behaviours associated with the recovery category.

It is also worth noting here, and for other hazards examined within this report, that the term 'community' does not have a universally agreed upon definition. For the purposes of this report, we refer here to 'communities' as groups of people engaged in some social activity or activities, e.g. communities could be geographical communities, communities of interest, e.g. arising from interaction through a shared interest, professional or working communities, or other communities such as those arising from specific circumstances (for a more detailed discussion of communities please see Birkmann et al., 2012).

Table 3: Flood risk perception and preparedness intentions and behaviours. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Author(s), Year	Geography	Research Design	Research variables	Key Findings
Terpstra (2011)[1,2]	The Netherlands	Residents, OQ, Affect Heuristic	RP: Likelihood, Impact, Affect; BV: Preparedness; OIV: Experience, Demographics	Cognitive and affective mechanisms influence citizens' preparedness intentions. In line with the affect heuristic, both positive (solidarity) and negative emotions (powerlessness) are related to prior flood experiences.
Siegrist and Gutscher (2008)[1,2]	Switzerland	Residents, FI, Affect Heuristic	RP: Affect; BV: Mitigation, Preparedness; OIV: Experience	It is demonstrated that people who are not impacted strongly by a flood underestimate the potential negative affect associated with a flood. Risk communication should include both technical expertise and affect.
Kriebich et al. (2007)[1]	Germany	Companies, TI, Theory (n.s.)	RP: Awareness, Likelihood; BV: Mitigation, Preparedness, Insurance; OIV: Experience, Length of time at the location	Weaknesses in the Elbe flood-warning system are evidenced through relevant companies' low preparedness and precaution during the 2002 flood. The potential for more precautionary measures is highlighted.
Wagner (2007)[1]	Germany	Residents, FI/TI, Mental Model	RP: Awareness, Affect, Cause; BV: Non-protective response; OIV: Experience, Demographics	It is shown that mental models concerning flash floods are much better developed than those for landslides. The physical processes for flash floods are easier for the general public to recognize and understand. People who have a better knowledge of the hazard have prior experience, are fearful of the hazard, and have been informed through multiple sources.
Zaalberg et al. (2007)[1]	The Netherlands	Residents, MQ, Protection Motivation Theory	RP: Affect, Likelihood, Impact; BV: Mitigation, Preparedness, Non-protective responses; OIV: Experience, Demographics	Results of a Structural Equation Modelling (SEM) show previous flood experience is associated with social support, worry, vulnerability, perceived flood consequences, and intentions to take adaptive actions. Results may inform the development of interventions to assist residents in knowing how to act effectively in case of an imminent flood.
Thiekin et al. (2007)[1]	Germany	Households, TI, Theory (n.s.)	RP: Awareness, Likelihood, Impact BV: Mitigation, Preparedness, Insurance; OIV: Experience, Risk Area, Perceived quality of the building	Knowledge about self-protection, residents' homeownership, and household size are found to influence the extent and type of private precautions taken, as well as the residents' ability to perform mitigation measures.
Grothmann and Resusswig (2006)[1,2]	Germany	Residents, TI, Protection Motivation Theory	RP: Perceived probability/severity, Fear; BV: Mitigation, Preparedness, Information seeking, Non-protective responses; OIV: Experience, Trust in flood protection	The explanatory power of the PMT model is shown. To motivate people for damage preventing, it seems essential to communicate not only the risk of flooding and its potential consequences, but also the possibility, effectiveness and cost of private precautionary measures.

Table 3 (continued): Flood risk perception and preparedness intentions and behaviours. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Author(s), Year	Geography	Research Design	Research variables	Key Findings
Steinführer et al. (2009)[3]	Germany, Italy, United Kingdom	Residents, MQ, FI, No specificed theory	PBV: Mitigation, Preparedness OIV: Demographics, Responsibility	Examines residents' perception of flood risk before and after a major flood event. Factors influencing risk perception, and perceptions of usefulness and responsibility for different protection and mitigation measures, both private and public, are explored. Risk perception increased after a flood. Age influenced peoples' perceptions of likelihood of another flood event. Private mitigation measures were ranked by respondents as the least useful and public as most. Findings may reflect low awareness by individuals of their responsibilities outlined in new legislation.
Kreibich et al. (2009)[1]	Germany	Households, TI, Theory (n.s.)	RP: Affect; BV: Mitigation, Preparedness; OIV: Experience, Protection responsibility	The study reveals that a minority of respondents consider the groundwater flooding a risk. Respondents perceive public authorities as bearing primary responsibility for preparedness and emergency response efforts.
Terpstra and Gutteling (2008)[1]	The Netherlands	Residents, OQ, Theory (n.s.)	RP: Likelihood, Affect, Impact; BV: Mitigation, Preparedness; OIV: Protection responsibility, Trust in flood protection, Demographics	While 73% of the respondents regard the government as primarily responsible for flood protection, about 50% view disaster preparedness as an equal responsibility between citizens and the government. This may indicate an open attitude by many regarding communication about disaster preparation measures.
Botzen et al. (2009b)[1]	The Netherlands	Homeowners, OQ, Theory (n.s.)	RP: Likelihood, Impact; BV: Mitigation, Preparedness, Insurance; OIV: Experience, Distance from river, Elevation relative to water level, Dike protection	This study finds that many homeowners are willing to invest in mitigation when a premium reduction is offered as an incentive. Results from a probit model indicates that existing arrangements for compensating flood damage, risk awareness and perceptions, and geographical characteristics are important determinants in the decision to undertake mitigation.
Nunes Correia et al. (1998)[1]	Portugal	Residents, shop keepers, experts, FI, combines risk perception, socio-economic, and physical data, Theory (n.s.)	RP: Likelihood, Cause; BV: Mitigation, Preparedness; OIV: Experience, Residential history	Extensive interviews engaging different actors (e.g. residents and shopkeepers (with and without flood experience), flood experts, and decision makers) are conducted. Results are used to inform public participations and policy.
Brilly and Polic (2005)[1,2]	Slovenia	Residents, FI, Theory (n.s.)	RP: Awareness, Likelihood, Impact, Affect; BV: Preparedness, Insurance; OIV: Experience, Risk area; Risk beliefs	The perception of a flood threat depends, to a certain degree, on the place of residence. Solidarity and the importance of insurance against floods are shown.

Table 3 (continued) Flood risk perception and preparedness intentions and behaviours. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Author(s), Year	Geography	Research Design	Research variables	Key Findings
Miceli et al. (2008)[1]	Italy	Adults, TI, Risk-as-Feelings	RP: Likelihood, Impact, Affect; BV: Mitigation, Preparedness; OIV: Experience, Distance from nearest watercourse, Demographics	The general preparedness level for future flood disaster seems high, and is positively correlated with risk perception and feelings of worry. No significant relation is found between likelihood judgments and adoption of protective behaviours.
Botzen et al. (2009a)[1,2]	The Netherlands	Homeowners, OQ, Theory (n.s.)	RP: Likelihood, Impact, Cause; BV: Risk behaviour; OIV: Experience, Distance from river, Elevation relative to water level, Demographics	Perceptions of flood risk are generally found to be low. Four factors are identified for explaining risk perceptions: (1) actual risk levels, (2) dike protection, (3) knowledge of the flood cause, and (4) age and education. Recommendations are presented for policy makers.
Harries (2008)[1]	United Kingdom	Householders, FI/FG, Social Representations Theory	RP: n.s. BV: Non-protective responses; OIV: Representational barriers (home, society, nature)	The desire to feel secure can sometimes deter people from taking actions that would reduce the actual physical damage of a hazardous natural event. The role of emotions and social representations in risk perception is underlined.

[1] Modified after Kellens, Terpstra and DeMaeyer (2013). [2] Study included in both Kellens, Terpstra and DeMaeyer (2013) and Wachinger, Renn, Begg and Kuhlicke (2013). [3]Reference added from Wachinger and Renn (2010).
[4] References added from Wachinger, Renn, Begg and Kuhlicke (2013).

Of the studies reviewed here, prior hazard experience and emotion are commonly cited as factors influencing preparedness or preparedness intentions (Table 3). Terpstra (2011) finds both cognitive and affective mechanisms influence citizens' preparedness intentions. Zaalberg et al. (2007) show prior flood experience is associated with social support, worry, vulnerability, perceived flood impact, and preparedness intentions. Other studies show that prior flood experience generates better hazard knowledge and fear of flood hazards (Wagner, 2007), or that a lack of prior flood experience leads to low levels of preparedness (Kriebich et al., 2007). Siegrist and Gutscher (2008) demonstrated that people who are not impacted strongly by a flood underestimate the potential negative affect associated with a flood. Miceli (2008) finds preparedness levels to be generally high and positively correlated to risk perception and worry.

However, prior experience can also trap people into expecting the same again, the so-called 'prison of experience' (Kates, 1962); where people expect the present and the future to be like the past (Fordham 1998: 131). Thus, if a previous event resulted in minor disruption and impact then they are unlikely to plan for anything more significant.

Other studies report risk perception, emotion, and risk area are important factors influencing preparedness intentions or actions. Brilly and Polic (2005) find that risk perception is influenced by place of residence and recommends the importance of fostering feelings of solidarity regarding flood protection. In a study undertaken by Correia, Fordham, Saraiva and Bernardo (1998), residential history, for instance, time in residence, in addition to prior flood experience, was shown to influence adoption of flood mitigation measures. Longer-term residents demonstrated a traditional culture of adopting precautionary and mitigation measures against floods. Newer migrants to the neighbourhood were less prepared. For example, newer buildings built by migrants frequently did not have floorboards installed to protect their residence, or systems to pump groundwater from basements.

Lack of knowledge of private precautionary measures and perceptions of responsibility for precautionary measures are addressed in several studies. Steinführer et al. (2009) demonstrate that citizens lack knowledge of private precautionary measures and rate them as least useful in comparison to publicly funded measures. In regards to less common flood hazards, Kriebich et al. (2009) show that a minority of respondents consider groundwater flooding a risk or private responsibility and furthermore, are ill prepared for this type of hazard event. At the household level, Thieken et al. (2007) find knowledge of self-protection measures and perceived ability to adopt protection measures influences the adoption of precautionary measures. Grothmann and Reusswig (2006) recommend that effective risk communication should not focus solely on flood risk, but also detail the possibility, cost, and effectiveness of private precautionary measures. This may support findings of Terpstra and Guttelig (2008), who reported that, while a majority of respondents felt that the government was responsible for flood protection, 50% felt that disaster risk reduction was a joint obligation between the government and citizens, and Botzen et al. (2009b), who found that homeowners would be willing to invest in mitigation measures when an insurance premium option is offered as an incentive.

Botzen et al. (2009a) found individuals in higher risk areas such as the vicinity of a main river and low-lying (low elevation) areas near a river had higher risk perception than those residing in areas of lower

flood risk. In addition to actual risk, individuals who lacked knowledge of the cause of flood hazards had lower risk perception and there was some evidence that older, more educated individuals had lower flood risk perception. Harries et al. (2008) found non-protective responses may arise from a desire to feel secure, which at times may deter people from taking actions that may reduce their hazard risk.

3.2 Other flood risk perception studies

Mitigation and preparedness are often used interchangeably in the preparedness literature, though typically mitigation refers to 'passive' measures taken when flood threat is not imminent (Sutton and Tierney, 2006). The following section examines risk perception and preparedness in activities characterized as 'preparedness' and/or 'mitigation.'

Several studies showed that experience influenced knowledge and emotion regarding the type of mitigation measure preferred (Table 4). Both Felgentreff (2003) and Sligner et al. (2007) gauged perceptions during different times of flooding, finding support for different types of mitigation measures varied with respondents' role and experience. Felgentreff (2003) investigated people's flood risk perception during and after a flood event, finding that, during the event, people supported different mitigation measures (non-structural, such as land use change) compared to after the event (e.g. no longer calling for alternative measures, but supporting status quo reinforcement of existing measures). An additional flood event, however, made respondents again question their beliefs regarding mitigation measures. Slinger et al. (2007) reported Flemish respondents generally had less trust in structural measures (dikes) than did Dutch correspondents; however, Flemish respondents had higher levels of trust in the government after a flood event. Among all respondents, a general lack of knowledge was found regarding protective measures (e.g. evacuation plans). Policy makers, while unsurprised at the public's lack of knowledge regarding evacuation, did not view non-structural or alternative measures, such as land-use change, as essential to flood risk management.

Questioned responsibility for mitigation measures emerged as potential impediments to flood security in several studies. An international sample showed a general trend of limited interest in flood hazards, reluctance toward moving, and a lack of consensus between the general public and authorities is outlined in Krasovskaia et al. (2001). In a more role specific study examining privately owned recreational areas, McEwen et al. (2002) recommend that owners and managers at existing caravan parks (vulnerable sites, often on floodplains) need to be legally responsible for evaluating flood risk, deriving flood-action plans, and communicating this information to park users.

Table 4: Other flood risk perception studies. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. All studies performed cross-sectional surveys unless stated otherwise. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Authors, Year	Geography	Research Design	Research variables	Key Findings
Lara et al. (2010)[1]	Spain	Residents, FI/FG, No specified theory	RP: Impact, Cause; BV: n.s. OIV: Experience, time in residence	The degree of social involvement in the local community is related to flood awareness and the willingness to take actions.
Kaiser and Witzki (2004)[4]	Belgium, Denmark, Germany,The Netherlands, United Kingdom	Residents in flood prone regions, Survey delivered to households, No specified theory	RP: Perception; Awareness; Likelihood BV: n.s. OIV: Information; Communication; Participation; Demographics	Pilot sites in all the countries investigated showed areas with very low and very high awareness of the risk of coastal flooding. A majority of the people interviewed did not know what actions to take in the event that a dyke breaches.
Author et al. (2009)[1]	United Kingdom	Residents, FI, No specified theory	RP: Impact, Cause; BV: n.s. OIV: Experience, Demographics	The most severe sewerage floods are perceived to be those that flood domestic property. Public-amenity areas are viewed as being significantly less important. A failure-consequence model is constructed.
Burningham et al. (2008)[1,2]	United Kingdom	Residents, FI/FG, No specified theory	RP: Awareness; BV: n.s. OIV: Experience, Risk area, Length of time at present address, Social class Demographics	The most influential factor in predicting flood risk awareness is social class, followed by flood experience and length of time in residence. The importance of engaging with local perspectives on risk and making local people part of 'awareness-raising' processes are underlined.
Kellens et al. (2011)[1,2]	Belgium	Householders, MQ, No specified theory	RP: Likelihood, Affect, Impact; BV: n.s. OIV: Experience, Risk area, Permanent residence, Demographics	By use of multiple regression analysis, the risk perception of coastal residents (both permanent and temporal) is found to be primarily influenced by actual flood-risk estimates, age, gender, and experience with previous flood hazards.
Keller et al. (2008)[1]	Switzerland	Students (FI), citizens (MQ), Affect and availability Heuristics	RP: Likelihood, Impact; BV: n.s. OIV: Experience	Risk perception is influenced by: (1) length of time in risk information, (2) previous flood experience, and (3) affect (manipulated using photographs with flooded houses). The importance of evoking negative affect (fear) in risk communication in order to raise risk perception is stressed.

Table 4 (continued): Other flood risk perception studies. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. All studies performed cross-sectional surveys unless stated otherwise. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Authors, Year	Geography	Research Design	Research variables	Key Findings
Ruin et al. (2007)[1,2]	France	Motorists, FI, Cognitive Mapping and GIS approach, no specified theory	RP: Awareness, Impact; OIV: Experience, Travel behaviour, Length of residence, Knowledge about protective actions	Cognitive mapping and GIS data are used to assess motorists' flash flood risk perception. Mental maps are used to inform planners of vulnerable areas, e.g. areas with high-risk and low-risk perception.
Terpstra et al. (2006)[1,2]	The Netherlands	Residents, MQ/FG, Psychometric Paradigm	RP: Increasing risk, Dread, Knowledge, Controllability, Number of people exposed, Risk-benefits, Trust BV: n.s. OIV: n.s.	49 questionnaires are evaluated using factor analysis. Eight flooding factors and three water-nuisance factors are identified. "Dread" is the recommended as the most important concept binding different factors.
Heitz et al. (2008)[1,2]	France	Citizens/farmers/councilors, MQ, No specified theory	RP: Awareness, Impact; BV: n.s. OIV: Risk area, Institutional trust	Significant differences in risk perception are found among the three types of stakeholders (citizens/farmers/councillors), particularly due to the location of these groups within the catchment. There is support for information provided by the local authorities.
Terpstra et al. (2009)[1]	The Netherlands	Residents, MQ/FG, Psychometric Paradigm, Persuasive Arguments Theory	RP: Increasing risk, Dread, Known to Science/Exposed, Controllability, Trust, Public support; OIV: Demographics	Results recommend attitude polarization may cause people to confirm their pre-existing hazard beliefs. This information may have important implications for risk communication.
Pagneux et al. (2011)[1]	Iceland	Residents, FI, No specified theory	RP: Awareness, Affect, Likelihood, Impact; OIV: Experience, Risk area, Length of residence	Main conclusions: (1) Poor awareness about historical inundations are apparent in the public; (2) the most effective source of hazard knowledge is previous experience; and (3) no correlation was found between the factors of awareness, risk estimation, and worry.

The geographical characteristics, or risk area, were also given emphasis in several studies concerned with flood hazard mitigation. Heitz et al. (2009) found significant differences in risk perception among the three types of stakeholders: citizens, farmers, and councillors, was particularly due to the location of these groups within the catchment. Similarly, Kellens et al. (2011) found actual flood risk estimates (e.g. individuals in areas of higher flood risk had higher risk perception), which vary with geography (high and low flood risk areas were assessed by experts), in conjunction with age (e.g. positive relationship between age and risk perception), gender (e.g. females had higher risk perception), and experience (e.g. having experienced a prior flood increased risk perception), predominantly influence coastal residents' risk perceptions.

Two other studies investigated risk area with a different, yet still geographic, focus: Author et al. (2009) found that residents perceived sewerage floods that impacted domestic property to be the most severe compared to those impacting public amenities. Ruin et al. (2007) assessed motorists' flash flood risk perception using cognitive mapping and geospatial data to generate vulnerability maps, e.g. areas with high-risk and low-risk perception.

In a factor analysis of risk perception questionnaires, Terpstra et al. (2006) identified eight common flooding factors and three water-nuisance factors. Dread was recommended as the important concept binding different factors. Terpstra et al. (2009) found attitude polarization may influence hazard beliefs.

Time in residence was linked to risk perception and emotion in several studies considering mitigation. Olicna Cantos et al. (2010) (Table 4) found lower awareness of flood risks in newer or seasonal residents. Keller et al. (2008) emphasized that risk perception is also influenced by the timing (e.g. length of time in risk information), prior experience, and affect. Pagneux et al. (2011) found prior experience to be the best source of knowledge and a low awareness among residents of historical inundations.

Both Burningham et al. (2008), in a UK study, and Lara et al. (2010), in a study in Spain, found social resources influenced flood risk: Burningham et al. (2008) found the most influential factor for flood risk to be social class, followed by flood experience and time in residence (Table 5). Lara et al. (2010) found the degree of involvement in the local community was linked to awareness and willingness to take actions.

Table 5: Other flood risk perception studies. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. All studies performed cross-sectional surveys unless stated otherwise. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Authors, Year	Geography	Research Design	Research variables	Key Findings
Lara et al. (2010)[1]	Spain	Residents, FI/FG, No specified theory	RP: Impact, Cause; BV: n.s. OIV: Experience, Temporary versus permanent residents, Public participation	The degree of social involvement in the local community is related to flood awareness and the willingness to take actions.
Kaiser and Witzki (2004)[4]	Belgium, Denmark, Germany,The Netherlands, United Kingdom	Residents in flood prone regions, Survey delivered to households, No specified theory	RP: Perception; Awareness; Likelihood BV: n.s. OIV: Information; Communication; Participation; Demographics	Pilot sites in all the countries investigated showed areas with very low and very high awareness of the risk of coastal flooding. A majority of the people interviewed did not know what actions to take in the event that a dyke breaches.
Author et al. (2009)[1]	United Kingdom	Residents, FI, No specified theory	RP: Impact, Cause; BV: n.s. OIV: Experience, Demographics	The most severe sewerage floods are perceived to be those that flood domestic property. Public-amenity areas are viewed as being significantly less important. A failure-consequence model is constructed.
Burningham et al. (2008)[1,2]	United Kingdom	Residents, FI/FG, No specified theory	RP: Awareness; BV: n.s. OIV: Experience, Risk area, Length of time at present address, Social class Demographics	The most influential factor in predicting flood risk awareness is social class, followed by flood experience and length of time in residence. The importance of engaging with local perspectives on risk and making local people part of 'awareness-raising' processes are underlined.
Kellens et al. (2011)[1,2]	Belgium	Householders, MQ, No specified theory	RP: Likelihood, Affect, Impact; BV: n.s. OIV: Experience, Risk area, Permanent residence, Demographics	By use of multiple regression analysis, the risk perception of coastal residents (both permanent and temporal) is found to be primarily influenced by actual flood-risk estimates, age, gender, and experience with previous flood hazards.
Keller et al. (2008)[1]	Switzerland	Students (FI), citizens (MQ), Affect and availability Heuristics	RP: Likelihood, Impact; BV: n.s. OIV: Experience	Risk perception is influenced by: (1) length of time in risk information, (2) previous flood experience, and (3) affect (manipulated using photographs with flooded houses). The importance of evoking negative affect (fear) in risk communication in order to raise risk perception is stressed.

Table 5 (continued): Other flood risk perception studies. Modified after Kellens, Terpstra and De Maeyer (2013). Research Design (Flood type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. All studies performed cross-sectional surveys unless stated otherwise. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Authors, Year	Geography	Research Design	Research variables	Key Findings
Ruin et al. (2007)[1,2]	France	Motorists, FI, Cognitive Mapping and GIS approach, no specified theory	RP: Awareness, Impact; OIV: Experience, Travel behaviour, Length of residence, Knowledge about protective actions	Cognitive mapping and GIS data are used to assess motorists' flash flood risk perception. Mental maps are used to inform planners of vulnerable areas, e.g. areas with high-risk and low-risk perception.
Terpstra et al. (2006)[1,2]	The Netherlands	Residents, MQ/FG, Psychometric radigm	RP: Increasing risk, Dread, Knowledge, Controllability, Number of people exposed, Risk-benefits, Trust BV: n.s. OIV: n.s.	49 questionnaires are evaluated using factor analysis. Eight flooding factors and three water-nuisance factors are identified. "Dread" is the recommended as the most important concept binding different factors.
Heitz et al. (2008)[1,2]	France	Citizens/farmers/councilors, MQ, No specified theory	RP: Awareness, Impact; BV: n.s. OIV: Risk area, Institutional trust	Significant differences in risk perception are found among the three types of stakeholders (citizens/farmers/councillors), particularly due to the location of these groups within the catchment. There is support for information provided by the local authorities.
Terpstra et al. (2009)[1]	The Netherlands	Residents, MQ/FG, Psychometric Paradigm, Persuasive Arguments Theory	RP: Increasing risk, Dread, Known to Science/Exposed, Controllability, Trust, Public support; OIV: Demographics	Risk perception is examined using conventional tests of the mean differences and tests for attitude polarization. Results recommend attitude polarization may cause people to confirm their pre-existing hazard beliefs. This information may have important implications for risk communication.
Pagneux et al. (2011)[1]	Iceland	Residents, FI, No specified theory	RP: Awareness, Affect, Likelihood, Impact; OIV: Experience, Risk area, Length of residence	This study draws three main conclusions: (1) Poor awareness and little worry about historical inundations are apparent in the general public; (2) the most effective source of hazard knowledge is previous experience; and (3) no correlation was found between the factors of awareness, risk estimation, and worry.

[1]Modified after Kellens, Terpstra and DeMaeyer (2013). [2] Study included in both Kellens, Terpstra and DeMaeyer (2013) and Wachinger, Renn, Begg and Kuhlicke (2013). [3]Reference added from Wachinger and Renn (2010).
[4]References added from Wachinger, Renn, Begg and Kuhlicke (2013).

3.3 Summary: Factors influencing flood preparedness

The most common factors influencing preparedness intentions and behaviours in the flood risk studies reviewed here for the European context are experience, knowledge, emotion (e.g. affect, worry), and risk area. For mitigation measures, experience and emotion again emerge as common factors with responsibility of different actors for different types of mitigation measures also emerging. Other flood risk perception studies placed greater emphasis on risk area, time in residence, and social resources as factors influencing risk perception.

Numerous studies, some of them cross-border or conducted in multiple countries, indicated a lack of knowledge of private precautionary measures or of protective actions to take during a flood event (Kaiser and Witzki, 2004; Grothmann and Reusswig, 2006; Kreibich et al., 2007; Thieken et al., 2007; Steinführer et al., 2009), including coping skills (Slinger et al., 2007; Figueiredo et al., 2009). This recommends a need to better incorporate this type of information into risk training and risk communication initiatives. Cross-border studies or studies investigating risk perception in multiple European countries were limited. However, those studies available recommend that risk perception varies broadly (Kaiser and Witzki, 2004), that there is a general lack of knowledge of protective measures (Krasovskaia et al. 2007; Steinführer et al., 2009), and that who is responsible for these measures remains questioned by the public (Krasovskaia et al. 07; Steinführer et al., 2009). This reinforces the need to detail legal responsibilities in risk communication materials, as well as training detailing both private and public precautionary measures.

3.4 Discussion: Flood risk perception and behaviour

Risk perception studies, among other benefits, have highlighted gaps in knowledge pertaining to public expectations of risk and associated responsibility, knowledge of protective behaviours, and fluctuations in hazard awareness. Few would argue that having knowledge of a risk and processing that knowledge, e.g. the perception process, is not a necessary step in preparedness. The influence of demographic variables such as age, gender, home ownership, etc. on an individual's risk perception is not always direct or easily detectable; however this does not imply that these are not essential factors for preparedness behaviour, rather, that they may not be essential to risk perception itself. Flood risk perception studies in the European context have shown that many people do not have knowledge of protective measures, especially private precautionary measures, or as the German case study illustrated, many lack knowledge of their legal responsibilities for flood protection. These are important representations of risk for policy and decision makers for evaluating how public opinion of preparedness may or may not reduce or create additional risk.

Risk perception itself may not be a panacea for understanding preparedness; nor is any other singular approach. However, as many results from social-psychological, health behavioural and sociological studies recommend, risk perception sometimes plays a significant role in preparedness. The flood risk case study below illustrates the dynamic nature of people's flood risk perception surrounding a flood event and how this information can be used to inform planning and policy.

Risk perception studies have been criticized primarily for their focus on individuals and many for the lack of focus on vulnerability, societal factors, or social norms that may influence behaviour. A focus on individuals, as opposed to groups of people or communities, implies that results are essentially

scalable from the individual to larger groups. Risk perception drawn from a representative sample of the population may indeed be representative of the risk perception of a community or region. However, it may not reflect relationships between individuals within the community, or with relevant institutions, networks, or government bodies that are necessary for the individual to adopt certain preparedness behaviours. Thus, many preparedness studies focused on risk perception have assumed that individuals have equal and fair access to the relevant resources to prepare for hazards and that the primary barrier that has kept individuals from this preparation is a lack of knowledge of hazards. This lack of knowledge of hazards is commonly referred to as an information deficit. Scholars within the risk perception field have noted this challenge and the need to focus on relevant indicators of vulnerability within risk perception studies (e.g. Kellens, Terpstra and De Maeyer, 2013; Wachinger and Renn, 2010; Wachinger, Renn, Begg and Kuhlicke, 2013).

Most risk perception studies focused on natural hazards include demographic variables such as age, education, gender, income level, educational level, home ownership and proximity to a hazard. Sometimes these factors are found to have a relationship with risk perception. For instance, frequently, being female is associated with higher risk perception, but this is not always the case. Similarly, most models incorporate demographic factors, but few studies can explain the variance in model results, or even attempt to (Bird, 2009; Kellens, Terpstra and De Maeyer, 2013). Thus there is continued debate in the field over these "mixed results."

Others have criticized risk perception as being only weakly related to preparedness behaviour, if related at all (see Miceli et al., 2008). Wachinger, Renn, Begg and Kuhlicke (2013) in a review of risk perception studies related to natural hazards in the European context, found that personal experience of a natural hazard and trust, or lack of trust, in authorities and experts, as well as confidence in protective measures to have the greatest influence on risk perception. The authors acknowledge that the links between risk perception and action (preparedness) are complex, involving a number of mediating and intervening factors. Additionally, the authors posit three possible explanations for what they term the 'risk perception paradox,' e.g. understanding why people may indeed have a strong understanding of risk, but not take action to prepare for the risk: (1) individuals understand the risks, however they accept them, as they perceive the benefits to outweigh the potential risks; (2) individuals understand the risk, but they do not perceive any agency for their own actions and instead transfer the responsibility onto someone else; (3) individuals understand the risk, but have little resources to affect the situation (see Kates, 1962; Fordham 1992).

Other preparedness studies, not specifically focused on risk perception, but with important lessons for preparedness, have examined gender and preparedness behaviour from constructivist and critical approaches. Studies on men's behaviour in developed countries also show that greater attention needs to be paid to gender and preparedness. Jonkman and Kelman (2005), for instance, analysed sex-disaggregated data of flooding fatalities from thirteen flood cases studies from Europe and USA. The authors also analysed the (sex-disaggregated) cause of death finding that males were far more likely to die during floods due to unnecessary risk-taking behaviour. Of the fatalities analysed where gender was reported, 70% were male with males being significantly overrepresented in flooding related vehicle crashes, drowning and physical trauma, and in cases of pedestrian drowning in comparison to females (Jonkman and Kelman, 2005). The authors conclude that the main contributing factors for the disproportionate number of male deaths likely include the large number

of males who drive, the high proportion of males who work in emergency services, and also the risk-taking behaviour of males, e.g. entering flooded homes to retrieve possessions, boating in floodwaters, driving across flooded streets or around barricades. Studies in Australia have shown differences and men's and women's behaviour with regards to natural hazards, e.g. men are more likely to engage in risky behaviour (see Heckenberg and Johnston, 2012). Findings from these studies recommend that addition of a gendered analysis can help to clarify 'mixed results' obtained in many risk perception studies.

Gender stereotypes can have negative implications for preparedness. Numerous disaster studies have found that women are more likely than men to better prepare for hazards. For example, women are more likely than men to hear evacuation warnings because of their greater involvement in social networks (Turner et al. 1979, 1981), to take warnings seriously (Drabek, 1969; Turner et al., 1981), to perceive natural hazards as more risky or serious (Szalay et al., 1986; Leik et al., 1982; Turner et al., 1986; Palm, 1995) and to evacuate (Drabek, 1969), unless they were at home with children or other family members (Drabek, 1969; Millican 1993).

However, gender stereotypes may negate women's proactive preparedness intentions; Enarson and Fordham (2000), in a joint UK, US case study illustrate examples where women's higher risk perception and intentions to take preparedness actions are dismissed as being stereotypical female 'panic' responses. Reviews of the disasters literature have illustrated that women are more likely to participate in the formation and operation of grassroots Community Based Organizations (CBOs) which are all central to preparedness and recovery-preparedness (Fothergill, 1999; Fothergill, Maestas, and Darlington, 1997). However, women's participation in CBOs is not always taken seriously (Neal and Phillips, 1990). Furthermore, women are markedly absent in decision-making positions, leadership roles, and higher levels of the emergency management field (Dann and Wilson, 1993; Williams, 1994; Morrow and Enarson, 1996). In other words, women have better preparedness intentions and behaviours, yet ascribed gender stereotypes often negate these measures.

3.5 Case study: Flood risk perception studies in Mulde, Germany

A study by Steinführer et al. (2009) aimed to investigate how people perceived the risk of being flooded prior to the 2002 flood and how people perceive their responsibility for different protection and precautionary measures. The primary objective was to extract how risk perception influenced the uptake of private precautionary measures. The research was carried out in 2005/2006 in three sections of the Vereinigte Mulde River. Data collection was through standardized questionnaire survey carried out in December 2005. The questionnaire survey applied a research design that consists of a self-administered survey with some elements of face-to-face interviews and postal surveys. Several key findings emerged from this study that can be used to inform future flood preparedness: Flood risk perception increased drastically after the flood event (pre-flood: 90% of respondents could not imagine a flood like that could happen to them, post-flood: 70% of respondents now believe that a similar or a "worse" flood could indeed happen to them, or happen again. Respondents were asked to rank how useful they perceived public versus private precautionary measures to be; results showed private mitigation and public disaster drills, rated as least useful (<35%). Respondents' rating of the need for an extension of warning period (77%) is interpreted by the authors as potential criticisms of the public flood warning system. Respondents were asked about

their knowledge of the new Saxon Water Law, which shifts more responsibility toward private precautionary measures. Results from this study generally conclude that the majority of respondents take a critical stance towards such a privatization of risk. Furthermore, pre-interview pilot studies showed that most people were unaware of the new law.

This case study clearly demonstrates a gap in knowledge pertaining to private precautionary measures, legal responsibility for these measures, and highlights a potential weakness in the early warning system. It couples more traditional risk perception methods, e.g. surveys, with in person interviews that help to better understand the context.

3.6 Preparedness in practice: Roles, responsibilities and floods

Over recent decades a shift has emerged away from traditional government towards a broader practice of "governance" (Rhodes, 1997; Walker et al., 2010; Walker, Tweed and Whittle, 2013). Hazard governance across Europe is diverse, as is the hazard landscape (Walker et al., 2010). The following section first provides an overview of trends observed in the European hazard context (Walker et al., 2010; Walker, Tweed and Whittle, 2013) followed by a more detailed discussion of changing roles and responsibilities at the community level under new governance.

Recent works by Walker et al. (2010) and Walker, Tweed and Whittle (2013) identify emerging trends and commonalities in European hazard context amongst the diversity:

- A shift towards greater diversity in the number of actors involved in risk governance
- New roles for different actors and stronger collaborations between actors
- Greater emphasis on relationships between levels of governance (e.g. multi-level governance)
- Shifts of responsibility away from the state
- Growing diversity in governance of hazards across Europe

Walker et al. (2010) note that, while the management of natural hazards has always involved a diverse set of actors, there are no longer clearly defined roles for states, NGOs, the private sector and local institutions (Chrisopolos et al., 2001). The authors point to the examples of the EU being more directly involved in natural hazards governance such as in pan-European provisions in the Water Directive and Floods Directive establishing cooperation and funding mechanisms for large scale emergency responses, as evidence of greater emphasis on multi-level governance (ibid). The UK's 'Making Space for Water' strategy (Defra, 2005), which maintains central government's control over flood risk management policy, but shifts responsibility for operationalization to the policy to the local level, is offered as evidence of a shift of responsibility away from the state. MSW is an example of a split between the 'rowing and steering elements of governance-with government continuing to set flood policy but at the same time seeking to shift responsibility for costs and actions to other segments of society' (Watson et al., 2009). Additional examples of the decentralisation of risk to the local level in Europe are presented via the examples of private citizens, businesses, farms, infrastructure managers and other stakeholders increasingly being asked to take greater responsibility for learning to 'live with water scarcity via demand management and the adoption of drought-sensitive farming methods' (Medd and Chappells, 2007; Memon and Butler, 2006). Finally, in terms of diversity in governance and hazards across Europe, flood management is used an illustration. German citizens in flood prone areas are obligated to take adaptation measures in accordance with their

'possibilities and abilities,' England and Italy actively encourages 'at-risk' stakeholders to prepare, and, in contrast, France and Slovenia do not expect citizens to reduce their flood vulnerability. Both Spain and Switzerland encourage citizens and businesses to collaborate in reducing vulnerability to drought and alpine hazards, respectively (Walker et al., 2010).

This section further examines changes to roles and responsibilities for different stakeholders at the community level utilising the MSW strategy as a case study example. Main points are highlighted followed by a case study providing more detail.

As Johnson and Priest (2008) illustrate the MSW strategy clearly outlines a vision of shifting flood risk management, or FRM, from the central government 'downwards' and 'outwards' to local authorities and private citizens. While few statutory changes have been made, a shift in responsibilities at both the central and local government levels is evident; at the level of central government, the Department for Communities and Local Government (CLG) is adopting an 'all-floods' hazard approach. At the regional level, the Environment Agency (EA) now has several new responsibilities including conducting a variety of flood risk and vulnerability assessments and administering grants to local level authorities and informal stakeholders for capital works. Informal stakeholders, such as landowners like the National Trust, developers, or other landowners of 'at-risk' properties such as low-lying agricultural areas are now responsible for not only avoiding and managing, but also, reducing, flood risk. Individual citizens are encouraged to accept greater responsibility for FRM through household adjustment options. Some challenges relating to MSW have emerged:

Insurance

- There is a reluctance of many homeowners to make FRM adjustments, as flood insurance will cover many of the damages incurred during flooding, leaving little incentive for homeowners to invest additional funds in FRM. Thus changes to flood insurance policy, such as additional requirements for household level adjustments to be eligible for flood insurance, may be necessary to facilitate adjustment uptake.
- The UK flood insurance industry states that it would consider changing insurance eligibility requirements; however, this has yet to be effectively operationalised.

Landowners

- Defra, the central government body overseeing flood risk policy, has duties related only to the alleviation of flood risk, but not for prevention or mitigation. There is no clear strategy in place for dealing with heterogeneity in flood risk, e.g. from a cost benefit perspective, the financial burden for localized FRM will be greater for rural inhabitants (Johnson and Priest, 2008).

Businesses

- There is no clear analysis or consideration of how the shift toward local FRM may impact different business sectors. Landowners or developers in 'at-risk' areas who have essentially inherited the flood risk from prior government policies are now expected to overcome and reverse unsustainable practices with no financial incentives or gain in legal rights.

Case study: Shifting roles and responsibilities of different stakeholders under England's 'Making Space for Water' strategy

Flood risk management (FRM) in England, as with many European countries, has shifted away from a state-centred approach towards one where other organisations, agencies, and individuals assume greater flood risk responsibility. Internationally efforts to increase public access and participation in risk management are also evident, for example, the Aarhus Convention, adopted by the EU and 46 other states, which grants public rights and regarding access to information, public participation and access to justice in matters concerning local, national and transboundary environmental concerns (EU, 2000). The paradigm shift towards risk management at the local level in England is evident in the government's 'Making Space for Water' (MSW) strategy. MSW aims to address risk responsibility by embedding FRM across government policy and through greater recognition and clarification of the roles and responsibilities of the stakeholders involved (Defra, 2004, 2005). MSW advocates for an 'all-flooding' approach to FRM where all types of flooding (e.g. river, coastal, sewerage, groundwater, etc.) are managed together.

Currently, the Department for Environment, Food & Rural Affairs (Defra), has primary responsibility for FRM at the government level. However, the Environment Agency (EA), Local Authorities (LA), and Internal Drainage Boards (IADBs) are responsible for delivery of Defra's FRM policies, e.g. they act as the 'operating arms'. Defra does not engage in activities such as building flood defences, issuing flood warnings, or making emergency plans, hence the role of the operating authorities is extremely important in delivering policy outcomes (Johnson and Priest, 2008). Informal stakeholders are also involved, as flood risk responsibility is further subdivided into those 'at-risk' of flooding. For instance, 'at-risk' stakeholders for flooding include developers, riparian, and non-riparian landowners. Legally, the Defra has no operational responsibilities. In contrast, the EA is legally required to exercise its functions via Regional Flood Defence Committees (RFDCs), in accordance to Defra's guidelines, for administering FRM on main rivers and Critical Ordinary Watercourses (COWs). FRM for ordinary watercourses falls under the responsibility of LAs and in low-lying agricultural areas with the IADBs. It is important to note that the responsibilities of the EA, LAs and IADBs are based almost entirely on statutory powers to alleviate flooding rather than any duty or requirement to prevent flooding (Johnson and Priest, 2008). The only duties the EA has are to supervise flood risk mapping and the issues of flood warnings (Howarth, 2003). In other words, the operating authorities may undertake flood defence work and maintenance but they have no duty to do so unless the situation warrants that they 'reasonably' could have prevented flooding. If, for example, an operating authority such as a sewerage undertaker fails to prevent flooding, where it reasonably could have been expected to do so, then the authority may be accountable depending on the legal interpretation of what is considered 'reasonable' (Johnson and Priest, 2008).

Ultimately, Defra is seeking 'a policy process dominated by the delivery of outcome oriented targets whereby Defra will provide block grants to operating authorities who will be 'free' to decide how to best spend this money (Defra, 2006). Effectively, Defra is seeking to shift the responsibility onto the operating authorities for the delivery of government policy while retaining control of the desired 'outcomes' of this devolution (Johnson and Priest, 2008, p. 518).

The EA is now the main operating authority in England as a result of the 'downward' shift in responsibility for FRM from Defra. Notable changes to EA include receiving block funding (estimated at £419 M for 2006/07), since 2006 the EA has taken over responsibility for allocating grant aid to LAs and IADBs for capital improvement works, and the EA is now responsible for certain high-risk ordinary watercourses (Johnson and Priest, 2008). Effectively, these changes have made the EA the primary strategic operating authority for ensuring the policy visions of MSW are achieved.

The vision of MSW also places greater responsibility on citizens for FRM stating that there will be a 'clear understanding and acceptance of the roles of the state, central and local government, other organizations and agencies, and of individuals' (DEFRA, 2005). A key area where DEFRA is trying to encourage individual responsibility is through the adoption of household adaptation measures; however, financing of these schemes is a major obstacle to uptake (Johnson et al., 2007). Currently there are no funding schemes available to support individuals with household protection, however, under MSW a feasibility study is being undertaken to investigate the potential costs and benefits of a grant based scheme (DEFRA, 2007). In addition to financial measures, Johnson and Priest (2008) note that there needs to be greater attention to public opinion and media portrayal that favours structural flood defences. For homeowners with flood insurance, who thus know they will be reimbursed when flood damage occurs, there may be little incentive to adopt household adjustments. Uptake therefore might be reliant on insurers changing their policies on high-risk areas or requiring that homeowners take more responsibility of FRM of their property in order to gain insurance (Johnson and Priest, 2008). However, while the UK flood insurance industry states that it would consider the risk reduction benefits of individual homeowner adjustments, potentially adjusting premiums based on the uptake of adjustments, this has yet to be effectively operationalised (Johnson and Priest, 2008).

Other key landowners such as the National Trust, which are responsible for large areas of coastline in the UK, will be required to take a much more active role in FRM under the MSW. Many important historic sites and properties exist within the National Trust land, so a potential complication may arise if these properties need to be abandoned (Johnson and Priest, 2008).

4. Risk Perception and Preparedness: Earthquakes

The occurrence of geophysical hazards remained relatively stable in Europe over the 1998-2009 time period, with earthquakes causing the most fatalities (approximately 19,000) and costing roughly EUR 29 billion in losses (EEA, 2011). Traditional risk perception studies on earthquakes (e.g. those looking for factors at the individual level that may influence risk perception and thus impact preparedness decisions) are less prevalent in the academic literature on earthquakes in comparison to floods, likely because of the comparatively lower frequency of large scale earthquakes, but also because many studies have shown that risk perception is not as critical a factor influencing preparedness behaviour for earthquakes. Other factors such as social norms, attitudes, beliefs and personal resources have been found to be more influential factors for preparedness behaviour. This section first begins with key points for researchers and practitioners followed by more in-depth discussion of risk perception and risk realization studies on earthquakes.

4.1 Key points for researchers and practitioners: earthquakes

Knowledge/information

Key findings

- Risk communication is more effective in prompting earthquake preparedness if it communities explicit information on the risk and is consistent with social norms.
- Several studies found prior experience did not necessarily increase earthquake preparedness.
- Some studies have recommended legislative action is needed to enforce building codes and earthquake resilient development.

Key gaps

- Absence of studies outlining social and/or cultural norms relevant to risk communication across different communities in the preparedness literature. This applies to other hazards as well
- Roles and responsibilities at the local community level are not clearly articulated in the preparedness literature. This is true for all hazard types examined with some exceptions.

Responsibilities

Key findings

- Perceived responsibility and sense of community have been found in some studies to influence the pathway from preparedness intentions to preparedness actions. Other hazard types may benefit from this research.

Key gaps

- More work is needed evaluating the potential influence of perceived/actual responsibility on preparedness actions. This applies to other hazard types as well.

Motivation

Key findings

- A key message from earthquake risk perception studies is that risk perception does not directly lead to preparedness actions, rather, it is one factor among others influencing behaviour.
- Studies have found risk perception was related to certain types of preparedness measures (e.g. mainly relevant for the post-impact phase) but was not a strong predictor of preparedness on its own. However, some studies have found it is a motivator or precursor to preparedness intentions. Personal resources, such as self-efficacy and coping influence preparedness intention formation. Social norms, responsibility, and factors such as trust have been found to influence preparedness actions.
- Societies with higher collective efficacy tend to expect more preparedness intervention/support from the government.
- Some studies have shown attitudes and beliefs, such as fatalism and optimism, negatively impact preparedness across different levels of society/organisation.
- Several studies found females to have higher risk perception and elderly to have lower risk perception.
- Several studies have found home owners adopt more preparedness measures.
- Several studies indicate that the behaviour of ones' social reference group are important factors influencing preparedness behaviour, e.g. observing others in your social group taking preparedness actions positively influences preparedness behaviour

Key gaps

- Minority of studies focused on what motivates communities and community based organisations, as this may differ from individual motivation. This applies for other hazard types as well.
- Absence of EU wide comparison of legal roles and responsibilities for earthquakes.

Networks

Key findings

- Studies have found that strong family and community networks, characterized by planning and good communication, are strong predictors for preparedness
- Some studies have found disaster training alone may not increase preparedness.
- Some studies have identified the fragmented nature of institutions/organisations at the local level as an obstacle for preparedness. This applies to other hazard types as well.

Key gaps

- More studies are needed investigating the effectiveness of disaster risk reduction initiatives.
- Greater integration of psychological and social-psychological findings is needed for disaster training and guiding resource allocation after hazard events. This applies to other hazard types as well.

Resources

Key findings

- Housing recovery (e.g. planning for transitional and temporary housing) is an area requiring greater attention for preparedness planning. Some studies have shown the negative impacts of poor housing recovery planning on people (e.g. related to loss of livelihoods, isolation) and the environment (e.g. utilising green space or agricultural areas).
- Higher educational level generally leads to higher risk perception, but this is sometimes mediated by higher socio-economic status, which sometimes decreases risk perception.

Key gaps

- More cross-cultural and/or longitudinal studies are needed.

A review by Ronan and Johnston (2005) of a number of international studies on earthquake preparedness concluded that overall preparedness levels were universally low. While case studies in some areas showed slight improvements, e.g. studies in California by Lindell and Perry (2000), preparedness measures were not to exceedingly high standards (see Becker et al., 2012). In New Zealand, for example, despite a number of earthquake preparedness campaigns enacted, over half of residents reported to have taken no precautionary measures by the time of the publication of the Earthquake Commission Report in 2011, which was prior to the Christchurch earthquake (Becker et al., 2012).

Studies in Turkey have found that, while risk perception is high, the relationship between risk perception and preparedness, commonly termed seismic adjustments in the literature, has been shown to be of a small magnitude (Rustemli and Karanci, 1999) and generally related to response and recovery items with utility for the post-impact phase (Kirschenbaum, 2005; Palm and Carroll, 1998). Additionally, the most effective mitigation measures for earthquakes such as building with earthquake resistant materials or retrofitting buildings may simply be too expensive for many homeowners, or beyond the jurisdiction of renters. Thus, residents have to cope with the persistent risk of earthquakes and it is necessary to understand not only how they perceive this risk, but also how they cope with such an enduring risk.

This section explores other factors in addition to risk perception that may influence preparedness intentions and behaviours, including additional psychological factors, social factors, or other factors that have been shown to influence earthquake preparedness. A review by Solberg, Rossetto, and Joffe (2010) provides a synthesis of the major findings from the international literature on the psychological correlates and causes of seismic adjustment at the level of the individual and the household. Seismic adjustment behaviours here refer to all types of actions and behaviours undertaken by individuals or households that have the capacity to either reduce immediate risk of damage or loss during an earthquake, or to prepare for post-impact conditions such as structural measures regarding building materials and non-structural measures such stockpiling food and supplies that may adversely affect survival probabilities (Mulilis and Lippa, 1990; Spittal et al., 2006;

Tierney et al., 2001; Turner et al., 1986; Solberg, Rossetto, and Joffe, 2010). For the purpose of this review, seismic adjustments and preparedness are used interchangeably.

Similar to floods, prior hazard experience, damage or losses occurred during the hazard event, critical awareness, and risk perception have all been shown to influence earthquake preparedness, yet effects are variable and may not remain stable over time (Table 6). Other psychological influences including optimistic bias and normalization bias have also been shown to influence earthquake preparedness. Optimistic bias refers to a situation where people view themselves to be less likely to be harmed by risk than peers in similar circumstances. Optimistic bias has also been examined in flood studies, however for earthquakes it has also been explored as a coping mechanism (Karanci, 2006). Normalization bias may occur when those who do not incur great losses or damage during an earthquake may ignore subsequent warnings (see Mileti and O'Brien, 1992).

Table 6: Summary of key psychological factors that have been shown to impact seismic risk perception and preparedness.

Psychological factors	Key findings	Summary
Experience	Past earthquake experience increases risk concerns (Dooley et al., 1992; Gruev- Vintila and Rouquette, 2007; Karanci and Aksit, 1999; Kasapoglu and Ecevit, 2004; Jackson, 1981; Lindell and Prater, 2000; Palm, 1998; Plapp and Werner, 2006; Rustemli and Karanci, 1999; Solberg, Rossetto, and Joffe, 2010). Personal losses sustained (Helweg-Larsen, 1999; Mileti and O'Brien, 1992; Solberg, Rossetto, and Joffe, 2010) and how experience is measured (Lindell and Perry, 2000) further impact risk concern.	Experience increases risk concern, but impacts are variable depending on individual experiences and how experience is measured, and may not be stable over time.
Hazard salience and critical awareness	Critical awareness is often positively correlated to risk perception. However it has been found to be low in the absence of trusted warnings, predictions, or an imminent threat, despite experience or retelling of personal narratives (Armas, 2006; Jackson, 1981; Turner et al.,1986; Solberg, Rossetto, and Joffe, 2010)	Frequency of warnings and threat level impact critical awareness, despite retelling of hazard stories.
Risk perception	Positive correlations between risk perception and seismic adjustments have been found. However, this relationship has been shown to be of a small magnitude and only for certain types of adjustments (Rustemli and Karanci, 1999), generally related to response and recovery items with utility for the post-impact phase (Kirschenbaum, 2005; Palm and Carroll, 1998; Solberg, Rossetto, and Joffe, 2010)	Risk perception is not always a strong predictor of earthquake preparedness
Optimistic bias	People may see themselves as being less likely to be harmed by a risk then peers of similar age, gender (results variable before/after earthquake) (Helweg-Larsen, 1999; Spittal et al., 2005; Solberg, Rossetto, and Joffe, 2010)	Optimistic bias may inhibit preparedness while also serving as a coping mechanism.
Normalization bias	Those who experience little or no damage during an earthquake may be less likely to subsequent warnings (Mileti and O'Brien, 1992; Solberg, Rossetto, and Joffe, 2010)	Normalization bias may inhibit future preparedness efforts if not addressed.

Social factors, commonly referred to as demographic variables in the flood literature, such as age, gender, educational level and socio-economic status (SES), are also commonly explored in the seismic risk perception literature (Table 7). Many studies have found that the elderly are less concerned with earthquakes in comparison to younger respondents, possibly because they have experienced more earthquake events. Higher SES typically acts to decrease seismic risk perception however a higher educational level may mediate this effect. Studies have also recommended that it should not be assumed that people have a positive identification with place, which may in turn impact seismic adjustment.

Table 7: Summary of key social and material factors that have been shown to impact seismic risk perception and preparedness.

Social and Material factors	Key findings	Summary
"White male effect"	Members of socially powerful groups view themselves as less at risk compared to others.	Power of social group may influence perceived risk. Those with less power generally have higher risk perception.
Gender	Females and minority groups are at greater risk in many countries, both developed and developing (Armas, 2008; Armas and Avram, 2008; Dooley et al., 1992; Karanci and Aksit, 1999; Kohiyama et al., 2008; Lai and Tao, 2003; Lindell and Prater, 2000; Mulilis, 1999; Palm, 1998; Paradise, 2006; Spittal et al., 2008; Turner et al., 1986; Solberg, Rossetto, and Joffe, 2010); see also gender under 'norms and social identities'	Risk perception is higher among some more vulnerable groups, including females and minorities.
Age	Elderly may view earthquakes as less of a risk than young, possibly because they have survived more earthquakes (Dooley et al., 1992; Farley, 1998; Heller et al., 2005; Lai and Tao, 2003; Palm, 1998; Rustemli and Karanci, 1999; Simpson-Housley and Curtis, 1983; Spittal et al., 2008; Turner et al., 1986; Solberg, Rossetto, and Joffe, 2010).	Age has been shown to influence seismic risk perception. Elderly may view earthquakes as less of a risk.
Higher education level	Higher education level sometimes leads to higher risk perception (Armas and Avram, 2008; Paradise, 2006; Rustemli and Karanci, 1999; Solberg, Rossetto, and Joffe, 2010)	Education positively impacts seismic risk perception.
Higher socio-economic status (SES)	Higher SES and home ownership generally decreases risk perception (Farley, 1998; Lindell and Prater, 2000; Solberg, Rossetto, and Joffe, 2010)	SES may influence seismic risk perception and preparedness. Higher SES typically decreases risk perception.
Place identification	Studies have shown that people do not always have positive place associations (Stedman, 2002, 567–568; Solberg, Rossetto, and Joffe, 2010)	Negative place identification may decrease preparedness.

Social norms and identities emerge as important contextual framings for seismic adjustments and risk communication (Table 8). Many studies have shown that the behaviour of one's social reference group impacts one's behaviour. For instance, observing or perceiving that your peers are, or are not, adopting certain seismic adjustment behaviours frequently influences individuals to do the same. Many studies have also shown that traditional gender roles influence the type of adjustment activities people engage, e.g. women typically engage less technical activities compared to men, such as stockpiling food and supplies. Other studies, which will be discussed in later sections, have also shown that traditional gender roles of women, such as childcare and elder care, put them at a much greater risk during natural hazards (Peek and Sutton, 2003). For earthquakes this may be especially important, as childcare and eldercare activities frequently stipulate being indoors, which heightens risk due to building collapse. Social networks, both within a family and a community, are also cited as influential. It is commonly assumed that families and communities exhibiting helping behaviours and engaging in disaster risk reduction initiatives will be better prepared. However, as is discussed in the Turkey case study, very few studies evaluate the structure, effectiveness, or duration of events such as preparedness training programs or other resources aimed at strengthening social networks' seismic adjustments.

Table 8: The role of social norms and identities in adoption of seismic adjustments.

Norms and social identities	Key findings	Summary
Norms of a person's social reference group	Studies have shown seismic adoption increased when respondents observed other people adjusting (Mileti and Fitzpatrick, 1992; Mileti and Darlington 1997; Solberg, Rossetto, and Joffe, 2010)	Norms have a bearing on social adjustment behaviour (see for example Koehler, Kress and Miller, 2014 for discussion of nudge effects). If a person may be more likely to engage in preparedness if she/he observes others in their social reference group engaging in preparedness behaviours.
Social norms and risk communication	Seismic adjustments increase when risk information provides explicit, consistent norms (Mileti and Darlington, 1997; Mileti and Fitzpatrick, 1992; Mileti and O'Brien, 1992; Solberg, Rossetto, and Joffe, 2010)	Social norms must be considered for effective risk communication.
Gender roles	Consistent, stable differences in the types of adjustment activities were seen between males and females along traditional gender roles (Mulilis, 1999; Solberg, Rossetto, and Joffe, 2010)	Gender roles frequently influence the type of seismic adjustment activities engaged in.
Social networks	Families with an attitude of helping behaviour exhibit greater preparedness (Heller et al., 2005); individuals who engage in preparedness events within the community exhibit greater levels of preparedness (Turner et al., 1986; Solberg, Rossetto, and Joffe, 2010)	Social networks are strong predictors of preparedness (individual and community). Stronger social networks positively influence preparedness.

Finally, other important factors, many also noted in the flood risk literature, emerge as important factors in seismic adjustment adoption (Table 9). Public perception of seismic adjustment responsibility, similar to floods, shows cultural variations for earthquakes, and additionally may not be stable over time. For examples, studies in the Western US have shown a shift in perception away from government responsibility to the individual level. In contrast, surveys in Japan recommend individuals perceive the government to bear greater responsibility for seismic adjustments. US surveys also recommend that home ownership, time in residence, and presence of children or dependents in the household were positively correlated to seismic adjustment adoption.

Perception of control, self-efficacy, and collective efficacy are critical factors that need to be better understood to facilitate adaptive responses, as opposed to shorter-term adjustment. As Solberg, Rossetto and Joffe (2010) note, the majority of earthquake studies take place at the scale of the individual or household. While studies have shown that risk communication geared in specific ways, for example, communicating accurate details of material risk and in a manner cognizant of social norms, can have the effect of improving people's sense of control, there is an astounding lack of information regarding other obstacles the community may face in its effort to become adaptive versus adoptive. For instance, individuals or even communities may adopt seismic hazard adjustments that lessen the immediate damage during an earthquake, or promote survival in recovery phases. However, this may have little impact on the community's actual resilience if not linked to governance and vulnerability concerns. The authors cite the example of Mexico City slums; residents may take what actions they can based on the resources they have, but they will still be more vulnerable than others who start off with a better resource base. Even in areas with significantly higher social capital resources, in the absence of a dialogue informing an actionable plan with decision makers regarding the governance of hazardous regions, frequently, developers will still continue to build in hazardous areas with substandard building materials and disasters will ensue.

Table 9: Other factors influencing earthquake preparedness.

Other factors: Responsibility, Control, Efficacy, Fate	Key findings	Summary
Public opinion of adjustment responsibility	Surveys on the US West Coast have shown a shift in perceived responsibility from government to individuals over time (e.g. comparing Jackson, 1981 with Garcia, 1998; Lindell and Perry, 2000; Solberg, Rossetto, and Joffe, 2010). Surveys in Japan show the public place more responsibility on the government for seismic adjustments (Palm and Carroll, 1998; Solberg, Rossetto, and Joffe, 2010).	Public opinion regarding responsibility for seismic hazard adjustments varies by culture and is not necessarily stable over time.
Home ownership, time in residence, presence of children or dependents in the household	US surveys have shown homeownership, time in residence, and presence of children or dependents all increase adoption of seismic adjustments (e.g. Duval and Mulilis, 1999; Turner et al., 1986; Solberg, Rossetto, and Joffe, 2010)	Home ownership, time in residence and presence of children or dependents in the household has been shown to impact preparedness
Self-efficacy and control	Providing accurate information about why one type of building withstood ground-shaking where another type collapsed, enables people to understand that building design is a major cause of losses and to infer that losses are controllable (Cowan et al. 2002; McClure et al., 1999, 2001, 2007; Solberg, Rossetto, and Joffe, 2010). Exposing people in high-risk zones to this information may lead to fatalistic feelings or denial and for those in low-risk zones to judge damage to be more preventable.	Accurate hazard knowledge may empower a person to feel control over potential hazard losses by taking appropriate measures. However, it may prompt fatalistic feelings if the person does not have adequate resources to adopt relevant adjustment measures.
Cultural discourse and the media	Historically, the media has rarely attributed disasters to human error (Steinberg, 2000; Fradkin, 2005; Rozario, 2007 Solberg, Rossetto, and Joffe, 2010). The relationship between powerful market actors such as property developers and a market friendly regulatory state creates inequality and vulnerability (Solberg, Rossetto, and Joffe, 2010), but this is rarely a focus for disaster risk reduction.	Individual beliefs about control and outcome are shaped by cultural discourse and the media
Collective efficacy	Several studies have shown that collective efficacy, e.g. when people are faced with uncertainty and look to others for support and guidance can have a positive influence on seismic adjustments (Paton et al., 2008, 2010; Solberg, Rossetto, and Joffe, 2010).	Collective efficacy influences seismic adjustments, as it impacts one's perceptions of responsibility.
Fatalism and partial fatalism	Positive correlations between fatalism and ethnic minority and negative correlations with education level have been found (Turner et al., 1986). Partial fatalism refers to findings that, while individuals may not feel they can prepare for seismic hazards, they still may feel there is something that their community can do to reduce risk (Farley, 1998 Solberg, Rossetto, and Joffe, 2010).	Fatalistic attitudes may be influenced by factors such as age, ethnicity, place identification, and perceived responsibility. These attitudes must be addressed in order to promote disaster risk reduction.

The review by Solberg, Rossetto, and Joffe (2010) cites examples where personal resources have been found to be significant predictors for how individuals may respond and recover from earthquakes, which feeds back into preparedness-recovery (Sutton and Tierney, 2006). The following case study examples from Turkey discuss the mechanisms for this as well as other intervening or mediating factors that also influence preparedness.

Large-scale earthquakes, such as the August 1999 Marmara earthquake, exert an extreme psychological impact on the population, especially women and those with previous psychiatric disorders (Basoglu et al., 2002; Benight & Bandura, 2004; Karanci, Alkan, Aksit, Sucuoglu, and Balta, 1999; Sumer, Karanci, Berument, and Gunes, 2005). Sumer, Karanci, Berument, and Gunes (2005) utilize Conservation of Resources (COR; Hobfoll, 1989) and social cognitive theory (Bandura, 1991) to evaluate psychological stress after the 1999 Marmara earthquake in Turkey. COR Theory recommends that people are motivated to obtain, retain, and protect socially valued and ecologically congruent resources to successfully cope with stress (e.g. material elements, such as housing, and social elements, especially employment, as well as personality traits such as self-esteem, optimism, and perceived control). In other words, in stressful situations, people aim to minimize resource loss and maximize resources.

Social cognitive theory (Bandura, 1991) proposes domain specific self-efficacy beliefs are important cognitive variables affecting successful adjustment to negative life events. Social cognitive theory implies that self-efficacy beliefs act as a buffer against stressors by enhancing people's motivation to seek additional resources and to use these resources efficiently under stressful situations (Benight & Bandura, 2004; Sumer, Karanci, Berument, and Gunes, 2005). Thus, examining both COR and social cognitive theory enables a better understanding of the role of self-efficacy in coping with the psychological distress caused by a disaster. As the authors note, considering the COR perspective, it can be assumed that a persons' disposition would play a significant role in reducing distress following a disaster, being also affected by objective and subjective losses. Considering both the COR and social cognitive perspective, coping self-efficacy is expected to mediate the relationship between dispositional characteristics and loss due to the earthquake and psychological distress. Individuals with high personal resources (e.g. self-esteem, optimism, perceived control) who experience low levels of resource loss as a result of the hazard are expected to have higher levels of self-efficacy and thereby experience lower distress (Sumer, Karanci, Berument, and Gunes, 2005).

Sumer, Karanci, Berument, and Gunes (2005) assessed the predictive power of personal dispositional resources (i.e. self-esteem, perceived control, and optimism), severity of the earthquake experience, and perceived self-efficacy for both general and event-specific (i.e. intrusion and avoidance symptoms) distress among earthquake survivors. A secondary goal was to investigate the mediating role of coping self-efficacy between resources, severity of earthquake experience, and psychological distress. Results recommend that people with a high level of personal resources tend to report higher levels of coping self-efficacy and lower levels of distress (i.e. intrusion and general distress). Coping self-efficacy strongly mediated the link between two critical personal resources; self-esteem and optimism with general distress. However, coping self-efficacy did not appear to be related to intrusion and avoidance symptoms, which the authors note may be a statistical artefact or because relevant metrics were not specific enough for the earthquake context. Results are consistent with prior work that recommends certain personality characteristics can be viewed as "robust" resources that buffer

negative effects of traumatic events, indicating the potential for use as predictors of the impact of disaster distress. Results also reinforce a gender effect, e.g. women experience greater general distress and intrusions as compared to men. The authors note, however, that the gender differences observed could be attributed to a number of factors, e.g. a majority of the female respondents in the study were housewives. Having to leave their home and being removed from their normal routines for months, this negative life condition for women seemed to have added to the distress they had following the earthquake. It is also plausible that men may not be willing to report their distress due to their socialization histories.

Sumer, Karanci, Berument, and Gunes (2005) recommend that future research should examine if personal resources have an impact on the effective use or mobilization of disaster aid and different types of support, which can also inform preparedness. The authors also recommend that more work is needed on communal versus individual behaviour, specifically, communal self-efficacy. Similar to the flood risk perception studies, a majority of earthquake preparedness studies are conceptualized at the individual or household scale instead focusing on communities and community dynamics, which is especially relevant in more collectivist societies. The authors note that Turkish culture is dominantly collectivist, giving priority to interrelatedness. Thus, the role of communal mastery, or simply, community behaviour, in predicting seismic adjustments should be a focus of future research. Evidence from earthquake studies in other countries further supports the need to address community or community level collective actions, e.g. work indicating that norms of one's social reference group impact seismic adjustments (Mileti and Darlington, 1997; Mileti and Fitzpatrick, 1992; Mileti and O'Brien, 1992), perceived responsibility (e.g. Palm and Carroll, 1998) and collective efficacy (e.g. Paton et al., 2003).

4.2 Other earthquake preparedness studies

Karanci, Aksit, and Dirik (2005) represent one of the few earthquake examples assessing the impacts of community awareness training programs. In 2002 a community disaster training program focusing on earthquakes, floods and landslides was implemented in Cankiri, Turkey. The program covered preparedness, mitigation, and response aspects of natural disaster management and engaged 4,000 community members. One year later, 400 randomly selected participants were evaluated in contrast to a comparable sample of non-participants. Disaster related cognitions (i.e. disaster expectation, worry about future disasters, loss estimations if a disaster occurs, beliefs in the possibility of mitigation and preparedness) and reported preparedness behaviours were assessed. The relationship of socio-demographic, previous disaster experience, anxiety and locus of control variables with disaster-related cognition and behaviours were also examined.

Results show that program participants had more disaster expectation, worry and loss estimation and more preparedness behaviours. However, overall reported preparedness behaviours were quite low, recommending that awareness and information do not automatically lead to preparedness behaviours, which supports studies in other regions (e.g. Paton 2008; Paton et al., 2005; Karanci, 2006). Regression analyses between study variables with disaster cognitions; affect and actual preparedness behaviours showed that gender, education, participation, anxiety and locus of control are important variables related to different kinds of disaster-related cognitions. However, reported preparedness behaviours were quite low and this result needs to be viewed with caution. This

analysis supports previous findings from Turkey, for instance, the effects of gender and educational level (e.g. Sumer et al., 2005; Tekeli-Yeşil et al., 2010, Table 8), and emphasizes the need to look beyond risk perception to understand preparedness behaviours (e.g. Rustemli and Karanci, 1999, Table 8).

4.3 Understanding preparedness at the community level

Karanci (2006) notes that the majority of psychological models developed to study preparedness behaviour surrounding natural hazards are focused at the individual level. The implicit assumption in these models is that if individuals are motivated to engage in earthquake preparedness, then the adverse effects will be mitigated. There is a lack of focused research and thus, understanding, regarding the motivation and capabilities of community level preparedness behaviours. In the example of Turkey, for instance, Karanci (2006) cites a unique study by Inelman et al. (2004), which evaluates motivators and inhibitors toward involvement in Community Based Organizations (CBOs), noting the need for more research in this area. The study looked at factors leading to reluctance on the part of community members to join a local disaster preparedness groups. The main reasons cited were uncertainty about the organizations goals, general unfamiliarity with the organization, lack of time, avoidance, and fatalistic attitudes. Additionally, the perception that it was the state's responsibility to undertake seismic adjustments further discouraged citizens from participating in the CBO.

There is a clear gap in knowledge regarding the effectiveness of community level preparedness measures, both how to motivate people to engage in community disaster risk reduction, and also providing evidence of the effectiveness of the actions for earthquakes and other hazards. In other words, there is a gap in knowledge on community-level outcomes (Karanci, 2006). Studies at the individual and household level across hazards have shown the importance of communicating the cost, effectiveness, and utility of mitigation and preparedness measures for other purposes, is an important factor in incentivizing adoption of these measures. Deductively, it would follow that the similar factors are important at the community level for incentivizing and generally promoting preparedness behaviours.

4.4 Summary: Factors influencing earthquake preparedness

In summary of Solberg, Rossetto, and Joffe's (2010) review, three primary categories emerge influencing seismic adjustments: personal resources (e.g. self-esteem, self-efficacy, coping self-efficacy, optimism, and financial); attitudes and beliefs (e.g. optimism, denial, fatalism, and control and responsibility, respectively); and social norms and factors (e.g. "white male effect", optimistic bias, normalization bias, collectivism, and demographic factors including gender, age, educational level, homeownership, and presence of children or dependents in the household).
Case studies from Turkey recommend the positive relationship between higher personal resources and higher coping self-efficacy and lower levels of distress. Coping self-efficacy also mediated the link between two critical personal resources, e.g. self-esteem and optimism, with general distress. Personal resources may have an impact on the effective use or mobilization of disaster aid and different types of support, which can also inform preparedness. A study of participants in a disaster training program showed that program participants had more disaster expectation, worry and loss estimation and more preparedness behaviours. However, overall reported preparedness behaviours

were quite low, recommending that awareness and information do not automatically lead to preparedness behaviours, which supports studies in other regions.

4.5 Discussion: Pathways from risk perception to preparedness: linking psychological and social resources

In a social-cognitive model of preparedness Paton (2003) groups critical awareness, risk perception, and anxiety as "motivators or precursors" to preparedness (Figure 1). Personal resources, including self-efficacy and coping, are grouped under "intention formation" in addition to response-efficacy, and outcome expectancy. Responsibility and wider social factors are included under mechanisms "linking intentions to preparedness." This model builds from health protective behaviours linking intention to action. As is noted by Paton (2003), numerous models of health protective behaviours describe the relationship between motivating factors and risk related intentions are mediated by intentions. Paton (2003) further distinguishes between preparedness actions that can be adopted on an individual level and those that require collective action. For example, securing furniture can be done on an individual level, but influencing zoning or land-use changes requires community participation and empowerment.

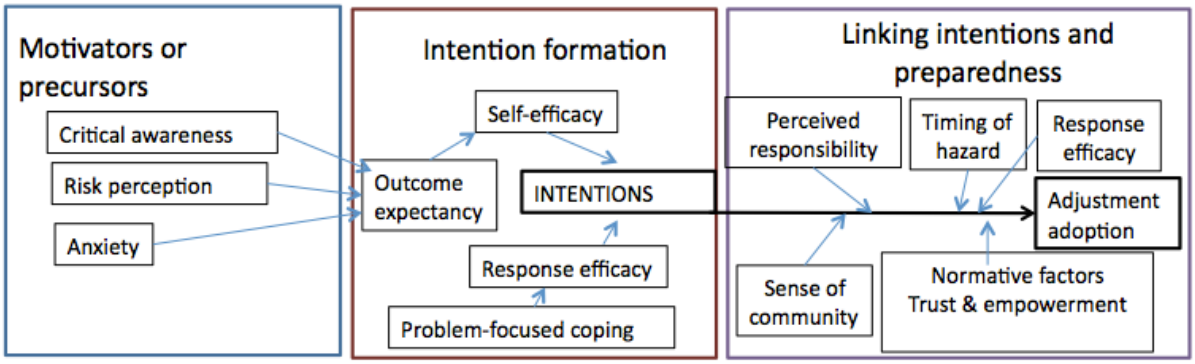


Figure 1: After Figure 1: The proposed social-cognitive model in Paton (2003).

The social-cognitive model does not recommend that risk perception is unimportant, rather, that other cognitive, emotional, and social factors are important on pathways between risk perception and preparedness. This proposed model is a generalization, e.g. for different hazard types and different individual and community contexts, certain variables may be more or less relevant and additional variables may require consideration. However, identifying general pathways between perception and preparedness, as well as the key factors framing phases within the pathway, may help to guide preparedness efforts.

As the earthquakes studies above illustrate, personal resources such as coping self-efficacy, social factors and norms such as observing the behaviours adopted by one's social reference group, attitudes and beliefs such as optimism and fatalism, and emotions are factors that may positively or negatively impact preparedness. The strength in social-psychological studies are in evidencing how these factors may influence individuals and groups with different attitudes, beliefs and norms, better enabling the direction of disaster aid resources, recommendations for clinical treatment, and content development for training and communication.

There is a gap in the literature regarding communal, or community, behaviour, as the majority of studies are conducted at the individual or household level. Additionally, more cross-cultural studies are needed to inform where collective efficacy, or other factors, may be more or less important.

Case Study: Mapping individuals' decision-making process for earthquake preparedness, New Zealand

Symbolic interactionism is a theoretical perspective framed by Blumer (1969) which argues that human behaviour is influenced by how people interact with and make meaning of their social environment. Applying a symbolic interactionist perspective, Becker et al (2012) explore social construction of reality and how individuals' social constructions are enacted in preparedness activities. A qualitative approach is applied where a process model is constructed from interview data describing cognitive, emotive, and social influences on the information meaning-making process. Results recommend that the decision making process for preparedness is not linear for all of the subjects interviewed; attitudes and beliefs regarding personal safety influence some individuals to interpret hazards and preparedness information in the context of those beliefs. Additionally, feedback loops were described by some respondents and actual preparedness levels often fluctuated over time.

The authors identify Social Cognitive Theory (Figure 2) as the theory (Bandura, 1968) which best fits the results of the process-based model, however they note that the model does agree with many aspects of prior work including the social-cognitive model (Paton, 2003), PrE, PADM, PMT and others. In Social Cognitive Theory, Bandura recommends that human behaviour is influenced by three main factors: personal determinants, e.g. cognitive factors such as knowledge, expectations, and attitudes; behavioural determinants, e.g. skills, practice, and self-efficacy, and environmental determinants, e.g. social norms, access in the community, influence on others. This study is a first in mapping out individuals' decision making process regarding preparedness actions, however, it is a qualitative study requiring testing and validation to understand if results are representative of the wider population and also, if it can be used internationally. This type of analysis could be useful for understanding the social and environmental context in which individuals are making decisions. Replicating the study for other levels of organizations, for instance, at the institutional and government level, may help to understand the broader community context.

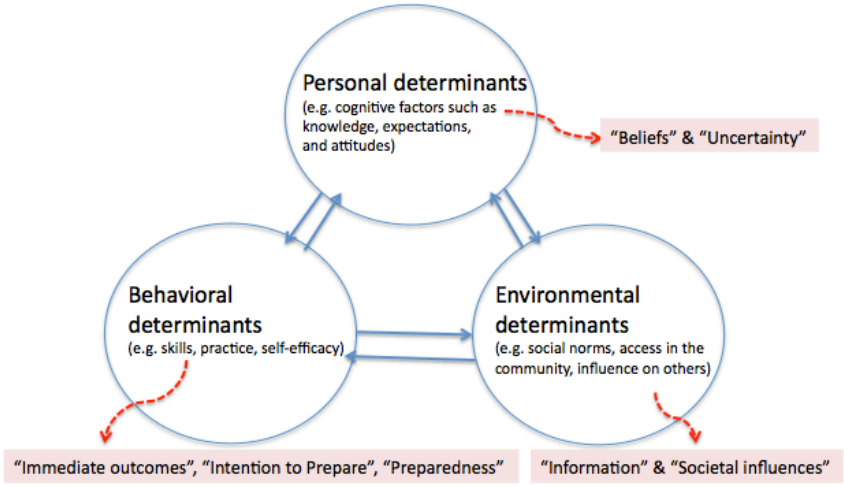


Figure 2: Modified after Becker et al (2012) figure 3 Social Cognitive Theory. Modifications include addition of red arrows and text in red boxes, which represent the primary categories from the process-based model that correspond to categories within Social Cognitive Theory. One potential weakness in the fit noted by the authors is the lack of focus on "emotion and feelings", which were found to directly influence behaviour in the process-based model.

4.6 Preparedness in practice: Roles, responsibilities and earthquakes

While the number of fatalities caused by disasters has decreased in developed countries, costs pertaining to property damage continue to rise (EM-DAT, 2014). Similar to floods, property damage is a common impact of earthquakes. In contrast to floods, building collapse is a leading cause of death during earthquakes and thus is a greater concern for earthquake preparedness. For example, Jonkman and Kelman (2005) examined the cause of morbidity during flood hazards in case studies from Europe and the US finding two-thirds of deaths resulted from drowning. Results showed that more people die in flood hazards outside of buildings in vehicle related deaths, e.g. 32.8 per cent of drowning deaths occurred in vehicles and 6.1 per cent occurred in buildings; 5.7 per cent of deaths due to physical trauma occurred in vehicles and 3.2 per cent in a building. In comparison, 75 per cent of deaths are caused by structural collapse of buildings in earthquakes (Spence, Coburn and Pomonis, 1992).

Building collapse has important implications for earthquake preparedness, especially in regions where a significant proportion of the population is at-risk from buildings that do not conform to earthquake resistant building standards. In Italy, for example, 70% of urban places are located in seismic zones, yet only one in six buildings is resistant to earthquakes (one in three in the most highly seismic areas) (Alexander, 2013). This is not to recommend that private citizens could not take on seismic adjustments including seismic retrofitting, e.g. actions to improve the structural resilience of a building during an earthquake. The same is true for floods, but perhaps with less urgency, as building collapse is less of a threat to life during floods. However, the cost of these measures is high in comparison to other precautionary measures which are most commonly practised across hazard types (e.g. having an emergency plan, stockpiling food and supplies, etc.). And also more extensive, as is the case for Italy; a citizen might have the financial means to have their home seismically

retrofitted, but whose responsibility is it then for all of the public buildings, or in the case of apartment dwellings or other connected houses, citizens would need to come together to have the entire structure renovated. The following section provides an overview and recent critique of earthquake risk management in Italy, followed by a more detailed discussion of Turkey. The devastating impacts of the 1999 earthquakes in Turkey resulted in a major revision of hazard governance from a more 'fatalistic' to 'self-reliant' approach to earthquake risk management (Balamir, 2002).

4.6.1 Earthquakes in Italy

Historically, Italy has experienced numerous earthquakes over recent decades that have resulted in loss of life, homelessness of tens of thousands of people, and significant economic losses. The Campania and Irpinia earthquakes in November of 1980, for example, killed 2,735 people and left 280,000 homeless (Özerdem and Rufini, 2013). More recently, the 06 April 2009 earthquake in L'Aquila resulted in the deaths of 208 individuals, leaving approximately 66,000 homeless and caused an estimated USD$16 billion worth of damages (Global Risk Miyamoto, 2009). Since 1968 there have been seven earthquakes measuring around 6-6.5 on the Moment Magnitude Scale in Italy in the Belice Valley (January 1968), Friuli (May and September 1976), Campania and Irpinia (November 1980), Umbria and Marche (September 1997), Molise (October 2002) and L'Aquila (April 2009).

In Italy a conventional disaster management model using four phases, e.g. preparedness, relief, reconstruction, and mitigation, is adopted with two main institutional components (Özerdem and Jacoby, 2006). The first is the Dipartimento della Protezione Civile (DPC), created in 1992 and charged with coordination and promotion of all preparedness and relief activities in accordance with the countries 20 administrative Municipalities, Provinces, and Regions (Özerdem and Rufini, 2013). Second is the 1998 Decree of Bassinini, which is a national law governing the distribution of roles and responsibilities between the central state and local authorities. This law details that the central state focuses largely on 'coordination and promotion' whereas the local authorities are attributed the majority of the decision-making power (Özerdem and Rufini, 2013). The DPC coordinates the fire brigades, the scientific community, and volunteer forces and, while it functions as a ministry, it responds directly to the government cabinet office (Alexander, 2002). The organization of emergency management at the regional/provincial level involves a Centro Operativo Misto (COM), which links the DPC at the national level and the Centro Operativo Comunale (COC) at the municipal level. Specific support functions are identified by the DPC for the COM and COC ranging from damage assessment, search and rescue, to social assessment and traffic control (Foster and Kodama, 2004).

In physical terms, the L'Aquila quake of 2009 was a moderate seismic event in contrast to the Iripina earthquake in 1980, which released 5.6 times more energy (Alexander, 2013). The high level of vulnerability in the built structures in L'Aquila meant that the impacts were disproportionately higher (ibid). As a result, the L'Aquila quake can be considered a test of the national civil protection in its current form (OECD, 2010) and an opportunity to appraise the evolution of policy and practise (Alexander, 2013). The following section highlights key some results of this appraisal by Alexander (2013) which considers housing reconstruction.

The emergency response was seen as swift and effective, as the most immediate need for shelter was met, however the reconstruction process has revealed a lack of preparedness planning for this phase and a 'top-down' political approach that was not consistent with the idea of decentralization (Alexander, 2013). Several salient obstacles to the reconstruction process in L'Aquila, all of which could potentially be addressed in future preparedness planning are summarized here:

Inadequate mechanisms for public participation in reconstruction

- Citizens are left out of discussions regarding their new homes: New towns and neighbourhoods are being built without consultation with the local authorities and beneficiary communities (DPC, 2009).

Lack of feasibility studies and environmental impact analyses for temporary and transitional housing sites

- Social, environmental, and economic feasibility studies are lacking for reconstruction: Many new towns are being built on green-field sites which presents social, economic, and environmental challenges, e.g. such sites require infrastructure (power, water, sanitation, shelter) and are often in isolated areas, far away from livelihood opportunities. Many green-field sites were formerly used for agriculture, thus there is a loss of agricultural lands, employment, and production. Other green-field sites provided habitat for wildlife and ecosystem services, the loss of which have not been addressed through environmental impact analyses.

Need for dialogue between citizens and decision-makers

- 30 prominent community based organizations or citizens' committees emerged after the quake, however no public forums have been convened between citizens and government to discuss concerns, no broad consultations with universities or the architectural community, and overall little dialogue has taken place between citizens and decision-making authorities (Özerdem and Rufini, 2013).

Lack of political power at the local level

- Politically, Mayors were given very restricted political powers and limited implementation roles (Özerdem and Rufini, 2013), which is inconsistent with the ideals and practice of decentralization.

From this brief discussion of housing reconstruction following earthquakes in Italy, it is evident that several challenges emerge that could be addressed with future preparedness planning:

- The responsibility for feasibility and environmental impact studies for housing sites needs to be identified for relevant authorities
- Roles for citizen participation in the housing reconstruction process need to be clearly delineated and avenues for this participation established
- The responsibilities of local level officials such as Mayors may require further clarification
- Institutional roles and responsibilities at the local level require clarification and strengthening

4.6.2 Earthquake risk management in Turkey: From a 'fatalistic' to a 'self-reliant' society

The devastation caused by the 1999 earthquakes in Turkey to devise new and effective methods of tackling disasters, spurning effort and debate across political, official and academic circles to revise attitudes, management, to restructure responsibilities, and to revise the legal framework (Balamir, 2002).

A new law, law 4452, enacted on 27 August 1999, empowered the Government with three major decrees of the Board of Ministers spanning the institution of:

- 'Obligatory Building Insurance'
- 'Building Control'
- 'Professional Proficiency'

Effectively, these changes reflect a change from a system that was formerly focused centrally on crisis management to one that focuses on disaster mitigation, e.g. contingency measures enacted before a disaster (ibid). Such a change reflects a transition from a 'fatalist society' to a 'prepared society' (Balamir, 1999), where the emphasis on society here has deeper implications beyond hazard planning to a social existence, reflected in styles of planning, modes of administration, and attitudes toward social organisation and 'life in total' (Balamir, 2002, p 39). Attributes of a 'fatalist society' versus a 'prepared society' from Balamir (2002) shown in Figure 3.

FATALIST SOCIETY		**SELF-RELYING SOCIETY**
	Disorganized Information — Information System	
	Post-Disaster Intervention — Pre-Disaster Conduct	
SAVING STRATEGY	Political Operation — Technical Issues	PROTECTION STRATEGY
HEALING DISCOURSE	Extraordinary Responses — Routine Procedures	PREPAREDNESS DISCOURSE
	Umbrella Funds — Specialized Funds	
CRISIS PLANNING	Risk Minimization/Sharing — Risk Avoidance	CONTINGENCY PLANNING

Figure 3: Source: Balamir (2002) attributes of two extreme models of strategy in disaster policy.

Transitioning from a fatalist to a prepared society implies institutional and legal changes, the adoption of new tasks and responsibilities, and restructuring of the functions and positions of existing roles of professions, particularly of those engaged with planning, design, construction, inspection and finances, in the case of earthquakes (Balamir, 2002, p. 41). 'Fatalist' and 'self-reliant' here refer not to individuals' personal belief structure or attitude, but rather reflect how the society in which individuals are living responds at an organisational level to minimize disaster losses. On the fatalist end of the spectrum, the role of the state and associated governmental bodies focuses on crisis management and ad hoc activities after the disaster event. On the self-reliant end, the state and associated government bodies focus more on strict control over development, making pre-disaster efforts routine.

Balamir (2002) posits that a fundamental attribute differentiating a fatalist from a self-reliant society is the 'maintenance of an organised system of information acquisition on disasters, data management, and the way the system is related to implementation'. The administrative and legal set-up needs to have clearly defined responsibilities for measuring, monitoring, and reporting disaster information. In the example of Turkey, an official national earthquake probability map segments the country into five regions, based on the statistics of seismic events. This information is then referenced against the 'Disasters Law' for engineering standards for each region. Next, information regarding natural conditions at an individual building site is requested. The Building Regulation, as a part of the Development Law, requires the individual property owner to submit a geological survey report of the building site to be approved for building permission.

If regulatory measures are focused primarily on crisis management and relief measures, as opposed to mitigation, then the emphasis for preparedness planning is characterized as more fatalistic. In this context, warnings of impeding disasters and reminders of the necessary precautions are considered 'scare-mongerism' (Balamir, 2002, p.42). Ignoring risks is considered a merit, to avoid forcing individuals to live in a 'risk society'. In contrast, preparedness in a 'self-reliant' society is integrated into social policy, sustaining alertness thought education, frequent drills, and training and routine safety inspections (ibid). Most of the legal provisions, citizens' concerns and practise, as well as the performance of administrations, local participatory mechanisms, and politicians are related to protecting and securing life and material assets (ibid).

In Turkey, Blamar (2002) notes that the 'Development Law' and 'Disasters Law' compose the two pillars of disaster policy. The 'Disasters Law' has focused primarily on post-disaster measures, such as providing housing for those displaced, determining property damage, and guiding the process of financing and distributing new accommodation for those eligible. In organisational terms, the law assigns the local governor the authority for managing the crisis, entrusting all responsibility for the immediate emergency and relief operations. Prior to 1999, there were almost no liabilities for municipal authorities solely responsible for the susceptibility of the built environment. This focus on post-disaster planning is more fatalistic than self-reliant, however, progress is evident; since 1999, the assignment and training of emergency personnel (obligations of the provincial government), have been more rigorously attended due to recent mandates (ibid). Prior to 1999, the Development Law contained no real mechanism or procedure to secure environmental building and implementation standards for mitigation control, essentially ignoring the reality and risks of earthquakes (ibid). Since the introduction of the Obligatory Building Insurance, Building Control, and Professional Proficiency provisions, the focus of activities has shifted toward risk management in the pre-disaster period.

In an effort to avoid unjust and inefficient distribution of resources after a disaster, the potential impacts of politicisation on preparedness planning should be considered. That is, a 'benevolent to all' approach is the standard response of authorities to disasters (Balamir, 2002, p. 42). However, this may not lead to efficient or fair distribution of resources and may serve to discourage individuals from taking precautionary preparedness measures at the individual level, and encourage further negligent behaviour with regards to development. Politicians themselves may benefit from this expectation in disasters. The 'Compulsory Building Insurance' intervention in Turkey has recently shown a digression from the trend of unconditional commitment to help every property owner reduced to only those who had their property insured.

Standard methods in disaster mitigation, and routine, as opposed to ad hoc, procedures in both pre-disaster and post-disaster phases are an indicator for a well-established 'self-monitoring' system in disaster policy (Balamir, 2002, p. 43). Prior to 1999, the registration of damaged buildings, the severity of damage, and the identification of building owners were the only routine procedures in Turkey contributing to post-disaster management (ibid). After 1999, a number of structural changes have been introduced that require routine mitigation processes. A 'Natural Disaster Insurance Administration' was established. Beginning in 2000, all building owners are required to pay annual premiums determined by earthquake zones, local risk levels, construction inspection certificates, structural intactness of the building, and the quality of construction (ibid). This makes insurance values higher for those not conforming to 'less-risky' standards. Only properties making regular premium payments are eligible for refunding in the event of natural hazard damage. Additional legal reforms require greater vigilance over construction processes and constructional professions.

Another indicator of a 'fatalist' versus a 'self-reliant' model of disaster management can be evaluated in terms of financial structure. Reliance on funds sourced from incidental donations or single budgetary allocations of the political body compliments the 'fatalist' attitude (Balamir, 2002, p 44). Reliance on funds that are structured out of continuous, even modest, flows of income are likely to be monitored more objectively, consistently and efficiently (ibid). Resources allocated for disaster relief are often donations without return and have lower productivities in per household terms. In contrast, resources used for mitigation purposes, since such allocations in the pre-disaster period are often used as seed-money to trigger and entice participators' investments, e.g. households aiming at retrofitting homes, or local authorities after the realisation of a municipal project, are more generative and efficient in achieving preparedness objectives. A balanced policy between mitigation and relief efforts is needed. In Turkey, the Disasters Fund (the Fund) has traditionally been the financial source for meeting the cost of disaster needs. The Fund was annually supplemented with allocations from the national budget, with expenditures from the Fund dispersed in the form of credits to be paid back over a 15 to 30-year period. The Fund was used for post-disaster relief and compensatory operations only, excluding mitigation. The Fund was rapidly depleted by a combination of factors pertaining to distribution policy mentioned earlier. The more recent introduction of 'Compulsory Earthquake Insurance' and the establishment of an organisation for its administration have significantly changed the funding policy. Private builders are now required to hold insurance to make a claim for compensation of disaster damage.

Balamir (2002) emphasizes that risk management should be performed in a logical sequence (Figure 4), giving priority to risk avoidance activities such as land-use planning services, as they can avoid most risks of natural hazards. The second phase focuses on securing robust and sustainable built infrastructure. Finally, as risks can be minimised but never fully eliminated, the third step focuses on equitable sharing of the financial burden of losses by the entire society.

1 - RISK AVOIDANCE

- Avoidance: avoiding areas of natural risks for settlement purposes
- Distancing: specifying minimum distances from nodes of hazard
- Refusal: prohibiting combinations of uses to cause chain-disasters
- Planning services: plan preparation/plan implementation/plan control/plan revision services

2 - RISK MINIMIZATION

- Discarding Risks at Source, e.g. flood-control reservoirs, artificial avalanches
- Upgrading Resistance at Location of Effect, e.g. levees, building codes
- Architectural and Engineering Services: higher standards in disaster-resistant design and construction/inspection of construction/building retrofitting services

3 - RISK SHARING

- Aid and Subsidies: credits, rent subsidies for dwellings and business premises
- Donations: national/international, voluntary/organized, cash/in kind donations
- Taxes: extra burdens on others than those suffered losses in the disaster
- Insurance: compulsory building insurance
- Financial Management Services: building up funds for pre-disaster and post-disaster requirements/efficient allocation of funds/maintaining equity between fund-providers and between fund-users

Figure 4: Source: Balamir (2002) Priorities in risk management in self-reliant societies.

To summarize, Balamir's model of 'fatalistic' versus 'self-reliant' strategies for disaster management and utilisation of Turkey before and after the 1999 earthquakes provided many salient examples for roles and responsibilities regarding preparedness across multiple levels and stakeholders. In a self-reliant model, for instance:

Individuals

- Shift in responsibility for individual property owners to purchase insurance and higher insurance premiums for practising 'risky' behaviour

Building contractors and land developers

- Shift in responsibility to purchase insurance and higher insurance premiums for practising 'risky' behaviours

Institutions and organisations

- Shift toward provincial government toward a more routine regime for training emergency personnel
- Establishment of a 'Natural Disaster Insurance Administration'

Government

- New legislation introduced pertaining to disaster finance and development
- Shift toward more formalised information management system (pre- and post-disaster)
- Shift toward more equitable compensation for disaster damage
- Shift away from umbrella funds to specialised funds

5. Risk Perception and Preparedness: Epidemics and pandemics

Epidemics and pandemics present a diverse set of challenges in terms of preparedness due to the high degree of uncertainty with regards to the origin and timing of these hazard events. For instance, it is not be possible to predict what the next strain of pandemic influenza will be and a variety of environmental and social factors can influence the duration and spread of the disease, so it could last for months or even years. Much of the planning for epidemics/pandemics is handled at the national and international level with the World Health Organization (WHO) and other actors coordinating cross-border plans for the handling of specific infectious diseases. Thus, at the community level, much of the planning is derived from 'top-down' initiatives engaging specific intervention measures to reduce impacts of diseases, for instance, school closures, delivery of vaccines, or quarantines. Thus, there is a strong focus on compliance with government directives that emerges in the risk perception and preparedness literature for epidemics/pandemics, as compliance with health protective measures will directly impact the spread and impact of the hazard event. Voluntarily engaging in health protective behaviour, such as hand washing, carrying tissues, wearing a facemask or respirator, or compliance with protective behaviour directives for healthcare workers, are topics that receive a lot of attention in the health preparedness literature. Additionally, avoidance behaviour, such as avoiding crowds, public transportation, or other 'high-risk' areas is another common focus. Finally, uptake of preventive treatments such as vaccines is an area of key concern for prevention prior to an outbreak and intervention during an outbreak.

In contrast to the human health literature, many traditional risk perception studies emerge for animal diseases pertaining to biosecurity measures. Emotions such as trust, resources, networks and other factors similar to risk perception studies for natural hazards are addressed in the literature.

This section focuses on risk perception factors influencing behaviour identified in the scientific literature utilizing a case study of potential pandemic influenza in the UK, as well as concerns that are less usual or novel in comparison to natural hazards, such as biosecurity. Biosecurity is an integral part and requirement of livestock production and there are a variety of biosecurity and health measures that can be taken along the food-processing chain, from producers to processors, for disease mitigation (Toma et al., 2013).

5.1 Key points for researchers and practitioners: epidemics/pandemics

Knowledge/information

Key findings

- Lack of information regarding protective measures emerged as a challenge to biosecurity for animal diseases
- Some studies recommended higher biosecurity preparedness in less rural farms; however, longitudinal studies are needed to identify trends
- Intervention strategies for infectious diseases such as school closures, travel restrictions; personal measures (use of face masks/respirators) are clearly outlined at the national and EU level. This is an area that could inform natural hazards planning and one that could also be improved by detailing interventions at the community level
- Veterinarians were frequently viewed as the most trusted sources of biosecurity information.

Key gaps

- Absence of literature focused at information for community level preparedness for epidemics/pandemics, as most of the information is at the level of central government.
- Lacking of routine training exercises to test compatibility of information systems and communication to respond to epidemics/pandemics. This applies to other hazards as

Motivation

Key findings

- Older age, being female, and being from a non-white ethnic background are factors that have been found to positively impact epidemic/pandemic preparedness
- Personal resources such as self-efficacy and emotion also emerge as factors influencing biosecurity behaviour and health preparedness
- Several studies found that higher perceived severity of a disease, perceived susceptibility/likelihood, and benefit (efficacy) of protective measures positively influenced preparedness behaviour.
- Trust emerges as an important factor for both animal/human diseases influencing preparedness. Local authorities are generally found to be more trusted, which can positively impact preparedness.
- Willingness to work during an epidemic/pandemic is a concern for medical personnel. Studies have shown that personal responsibilities (e.g. childcare/eldercare) can negatively impact willingness to work.
- At the scale of the EU, there is a hesitance by Member States to stockpile vaccines, where the preference has been to do this on a state-by-state basis.

Key gaps

- Lack of understanding of how peoples' perceptions of negative consequences of certain preparedness measures such as vaccines can be overcome. This is an area that might benefit from lessons learnt for risk perception from psychology/social-

Networks

Key findings

- Some biosecurity studies have found that membership in professional networks positively impacted biosecurity preparedness.

Key gaps

- The role of networks is not really examined for epidemic/pandemic preparedness. The natural hazards literature implies the importance of networks, however, little is done to actually measure and monitor the use/effectiveness of networks (beyond formal emergency response). Thus, greater consideration of the motivation and effectiveness of networks across hazard types could benefit preparedness.

Responsibilities

Key findings

- Willingness to work of healthcare personnel during a pandemic/epidemic emerges as a key concern in the literature. Some studies recommend a need to consider employee's childcare/eldercare responsibilities as motivating factors regarding willingness to work during a pandemic/epidemic.
- Biosecurity preparedness studies recommend differing opinions among stakeholders regarding responsibility for biosecurity related preparedness; some studies recommend veterinarians place greater onus on farmers to improve biosecurity whereas some farmers place greater emphasis on government responsibility.

Key gaps

- More work is needed on community responsibility for biosecurity and health preparedness.

Resources

Key findings

- Personal resources, social networks, other social factors and norms and environmental impacts were rarely examined in the studies reviewed here on risk perception. However, health promotion studies commonly examine the influence of these factors on health and wellbeing.

Key gaps

- Need for more trans-disciplinary analyses of risk perception, health promotion and preparedness to understand potential resource related obstacles.

One example for framing the discussion of preparedness for pandemics with global relevance is influenza. The influenza viral strain is constantly changing in relatively subtle ways, which means the human immune system may mount ineffective responses to those previously altered strains as they continue to alter over time (Department of Health, 2011a). Rarely, a radically altered, novel strain of influenza emerges to which human populations have little or no immunity (Department of Health, 2011a). If that particular strain is also effectively transmitted from human-to-human, then the conditions favouring a pandemic may occur. Four occurrences of influenza pandemic have been documented in the past century occurring in the years 1918, 1957, 1968, and 2009. The 1918 event was the most severe, causing an estimated 200,000 deaths in England and Wales and 50-100 million worldwide (Department of Health, 2011a). Because of the interconnectedness of modern cities and the prevalence of air transport, pandemic influenza could spread, for example, to the UK within a matter of weeks (SPI-M, 2010).

Following the 2009 pandemic influenza, a systematic review was conducted of demographic and attitudinal factors influencing preparedness by Bish and Michie (2010). Following the review, a report by the UK Department of Health in November 2010 updated the paper by adding new scientific studies meeting the inclusion criteria, e.g. (Department of Health, 2011b). This section focuses on key insights for risk perception and preparedness, which emerged from these two documents.

Bish and Michie (2010) categorized protective behaviours into three types: preventive (e.g. hygiene behaviours such as hand washing, wearing a mask or respirator, carrying hand sanitizing gel or tissues); avoidant (e.g. avoiding work or crowds, complying with quarantine); and management of disease behaviours (e.g. taking medication). Inclusion and exclusion criteria are detailed fully in Bish and Michie (2010), however, general criteria included: search terms (SARS, avian influenza/flu, H5N1, swine influenza/flu, H1N1, pandemics); forward searching of references and recommendations from the UK's Scientific Advisory Committee on Pandemics; and inclusion of studies that reported associations between demographic factors, attitudes, intentions, and behaviours. In all, 26 studies were found meeting the inclusion criteria and all but three lacked an explicit theoretical framework. The majority of studies were conducted during an outbreak (n=20), while the minority analysed how people would behave in the event of an outbreak (n=6). The majority of studies focused more

explicitly on factors associated with carrying out preventive behaviours (n=22), some also focused on avoidant behaviours (n=13), and others also included management of disease behaviours (n=10).

Bish and Michie (2010) found that being older or being female was associated with a higher chance of carrying out protective behaviours (Table 10). In the follow-on review, they found additional supporting evidence, but also reports of men adopting certain protective behaviours in Saudi Arabia and India; countries which were not reported on in the first literature review. Additionally, there was evidence that higher levels of perceived susceptibility to, and perceived severity of, infectious disease, as well as stronger beliefs in the outcome of protective behaviours, were associated with behaviour. Higher rates of anxiety and trust in authorities were also found to be associated with behaviour. In the follow-on review, demographic factors including age and educational level, as well as psychological factors, including risk perception, beliefs regarding the efficacy of preventive and avoidant behaviours, were found to be associated with reported intentions and behaviours.

Table 10: Illustrations of key findings from reviews of demographic and attitudinal determinants on preparedness behaviours for influenza by Bish and Michie (2010) and UK Department of Health (2011).

Factor	Preventive behaviours	Avoidant behaviours	Management of disease behaviours
Gender	Cross sectional studies on SARS in Hong Kong, Singapore, and swine flu in the UK found women were more likely to engage in protective behaviours, and to report more frequent hand washing at the start of an event, respectively. Other studies found no gender differences for intention to wear a mask, actual facemask use, or intention to be vaccinated. In Saudi Arabia and India, men were found to uptake some protective behaviour more than women.	Studies in Australia and the US found that women were more likely than men to report that they would comply with quarantine restrictions during a pandemic and a study in the US found that women were more likely to report avoidance behaviours at the start of the swine flu outbreak. A UK study found no gender differences in avoidance behaviours.	
Older Age	A cross sectional study in Hong Kong found older adults with lower educational levels were more likely to carry out protective behaviours.		
Educational level	Cross sectional studies in Hong Kong found that people with higher education levels report greater protective behaviours against SARS and avian influenza. Studies in Australia and Korea found people with higher education levels reported greater intention to wear a facemask during an outbreak and be vaccinated against influenza. In contrast, an Australian study found people will lower educational levels were more likely to report having taken protective behaviours during an avian influenza outbreak.	Studies in Hong Kong found that more educated people were more likely to avoid public places during the SARS outbreak.	Less educated people surveyed in the US were more likely to report they would be willing to be vaccinated against swine flu.
Ethnicity	Studies in the UK and US found non-white participants were more likely to take protective actions and engage in avoidance behaviours, and to say that they would have a vaccine for swine flu, respectively		A cross sectional study in the US found that Hispanic respondents were more likely to report that they would take an antiviral drug for

			swine flu. Studies in the UK, the Netherlands, Australia and Hong Kong found that ethnic groups were more likely to have carried out protective behaviours during the 2009 H1N1 pandemic.
Perceived susceptibility, severity, and efficacy	Many studies found that greater perceived severity of the diseases (such as its infectivity or the chances of dying from it) was associated with a higher chance of carrying out protective behaviours. Similarly, perceived susceptibility and belief in the benefit (efficacy) of protective measures has been found to relate to uptake of protective behaviours.	Studies in Australia found positive associations between level of concern and voluntary isolation or complying with quarantine. Similar results were found in cross sectional studies in the US, Netherlands, and Hong Kong.	

Older age, being female, belonging to a non-white ethnic groups and having a higher level of education, are all factors that have been associated with a greater chance of taking protective and avoidance behaviours (Department of Health, 2011a). Behaviour can play an important part in how an epidemic or pandemic progresses, for instance, whether or not individuals or communities comply with quarantines, or follow advice regarding vaccinations and antibacterial medications for secondary effects of influenza such as pneumonia. The following guidelines have been laid out (Box i) by the UK Department of Health (2011b) as a "defence-in-depth" strategy to mitigate the spread of influenza:

Box 1: Strategies for dealing with pandemic influenza include a range of measures such as:

(i) effective communication to the public, including skills training, to promote habits of stringent respiratory etiquette and hand hygiene, particularly amongst children;

(ii) environmental restructuring to consolidate habits of stringent respiratory hand hygiene via cues, prompts and improved access to respiratory and hand hygiene facilities, such as tissues and soap;

(iii) increased cleaning of solid surfaces potentially contaminated with virus, such as door handles or light switches;

(iv) prophylactic use of antiviral drugs, especially in the earliest stages of the outbreak;

(v) widespread treatment using antiviral drugs, in combination with behavioural and communication interventions to encourage pharmaceutical uptake;

(vi) widespread antibiotic treatment of secondary bacterial infections;

(vii) pre-pandemic vaccination, should an appropriate vaccine exist as the pandemic commences;

(viii) pandemic-specific vaccination, initially targeted at at-risk groups, in conjunction with behavioural and communication interventions to encourage vaccine uptake;

(ix) the use of facemasks and respirators to protect healthcare workers and encourage their attendance at the workplace;

(x) school closures, especially when they can be instigated early in a pandemic that is severe and where transmission is disproportionately high amongst children; &

(xi) restrictions on mass gatherings, including travel, especially in the event of a severe pandemic.

As can be observed from the guidelines in Box 1, mitigation of pandemic influenza is strongly reliant on risk communication to the public throughout the course of the outbreak, as well as resources for proper hygiene, medications, and conformist behaviour by the public to guidelines health care authorities. Behaviour of the public during natural hazards can influence the risk of individuals to themselves and to others, for example, not obeying a warning by local authorities to evacuate can put individual residents at risk, as well as emergency responders who may then attempt to rescue individuals. However, non-compliance with recommended hygiene behaviours, voluntary-isolation, or quarantine by individuals or groups of individuals may have the potential to cause much greater damage in the case of infectious disease due to the highly communicable nature of infectious diseases. Thus, compliance with advice of health care authorities is critical during epidemics/pandemics.

Behavioural interventions (e.g. preparedness strategies) are summarized in the review of scientific findings by the UK Department of Health (2011b) inclusive of the following measures:

Infection control

- Influenza can be transmitted between people via droplets and potentially aerosols; direct human contact; contact with contaminated solid objects; or contact of contaminated hands with the face or (potentially) eyes. Additionally, individuals may differ in their transmission abilities; infected children or immunocompromised patients may shed more of the virus than adults. Voluntary domestic isolation when a person exhibits influenza-like symptoms can help to curtail the spread. Similarly, cohort nursing, or grouping patients believed to be infected with influenza in the same area of the hospital, may also limit the spread. Cleaning solid surfaces with appropriate disinfectants can also help reduce the spread of influenza.

Facemasks and respirators

- Use of masks/respirators reduces the transmission of the virus via aerosols. Training and compliance (in the hospital setting) are important to ensure the effectiveness of this measure.

Encouraging the uptake of pharmaceutical interventions

- Studies have shown that uptake of influenza vaccines is sub-optimal by at risk groups such as health professionals, clinical risk groups, pregnant women, children, and the general population. Addressing omission bias (e.g. that harm caused by action is worse than harm caused by inaction) through proper communication regarding the benefits of vaccination alongside the risk of not being vaccinated may help to promote pharmaceutical interventions.

School closures, restrictions on mass gatherings and travel

- Studies on school closures and restrictions on travel or large gatherings are limited. However, available studies recommend that school closures may help limit the spread of pandemic influenza, however, the timing of closures is key. Similarly, restrictions on mass gatherings and travel may help reduce the spread of influenza yet these are more complicated in terms of defining the conditions for a mass gathering and/or specific types of travel.

Attendance of health care professionals to work during a pandemic

- For health care services to run efficiently during a pandemic, it is essential that health care professionals attend work. During the 2009 H1N1 pandemic, as many as 1/3 of health care professionals were absent. Available studies recommend that during a more severe pandemic, absenteeism of health care professionals may be a much larger problem. Men, older employees, employees without dependents, doctors and full-time staff are less likely to be absent. Research also recommends that emotions such as fear play a role in willingness to work by health care professionals during a pandemic, with fears of safety for one's family members/dependents a key concern.

5.2 Summary: factors influencing preparedness behaviour for infectious disease

Older age, being female, belonging to a non-white ethnic groups and having a higher level of education, are all factors that have been associated with a greater chance of taking protective and avoidance behaviours (Department of Health, 2011b). Conclusions from both Bish and Michie (2010) and the follow-on study (Department of Health, 2011) note that theories of behaviour such as the Health Belief Model, Theory of Planned Behaviour, Protection Motivation Theory and the Common Sense Model of Illness provide a basis for explaining the results. However, the authors also identify a key limitation in that the majority of the studies were not carried out within a theoretical context and theoretically driven prospective studies are needed to further clarify the relationship between demographic factors, attitudes, and behaviours. While not noted by the authors, this work is conducted at the individual or household level, so a second key limitation is a lack of understanding and evidence regarding community level preparedness.

Behavioural intervention strategies are well-outlined by the UK Department of Health, however, timing of interventions (e.g. school closures) and compliance with advice and restrictions set out by health care professionals and law enforcement are critical to the success of these measures. Figure 5 below (after UK Department of Health, 2011b) demonstrates the potential of combinations of different mitigation measures against pandemic influenza.

Number of clinical, hospitalisations and deaths for various countermeasure options with a raw clinical attack rate of 50% (SPI-M, 2010).

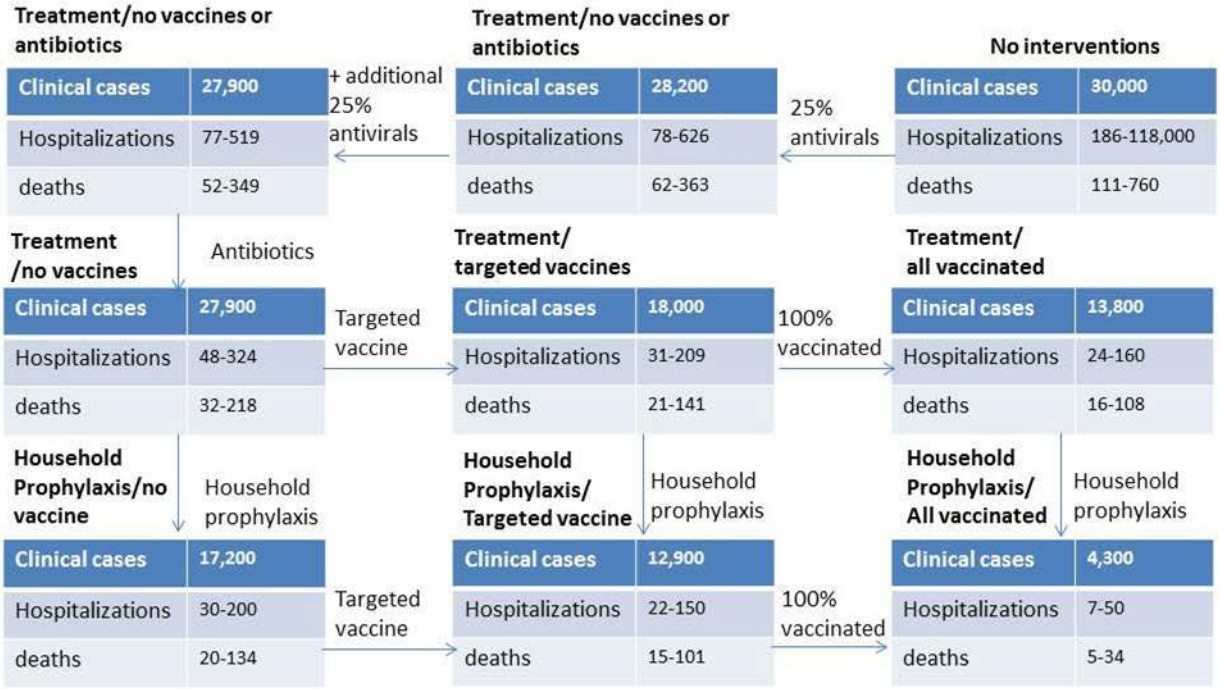


Figure 5: Combining different intervention measures to mitigate pandemic influenza. Adapted after UK Department of Health (2011b). Results based on a population of 60 million. All figures in the thousands. Relative school closure assumed under household prophylaxis.

5.3 Risk Perception and Preparedness: Animal Diseases

Up until now, this section has focused on the example of pandemic influenza in the UK relying primarily on scientific summaries and good practice as outlined by the UK Department of Health with a focus on impacts to humans. Some types of influenza may be transmittable between animals and humans, for example, strains of avian influenza. The remainder of this section focuses on potential preparedness challenges posed by animal diseases, specifically for biosecurity, with examples from Europe, the United States, Australia and New Zealand. Similar to the previous sections, this section cannot be comprehensive, as the range of infectious diseases is vast, thus the focus is on emerging factors or themes with potential implications for community preparedness.

Factors emerging from the literature influencing the adoption of biosecurity behaviours by farmers and the farming industry more generally shared many similarities to natural hazards (Table 11); perceptions, knowledge, attitudes, experience, trust, and resources, both personal and financial, emerged in several studies as key factors influencing the adoption of biosecurity behaviours.

Several studies found that risk perception was an important consideration in the adoption of biosecurity measures. Risk perception varied between different stakeholder groups and different biosecurity measures. Valeeva et al. (2011) found that perceived benefits of biosecurity measures was the strongest predictor of biosecurity adoption by farmers. Risk perception was found to vary

between farm size, stakeholder groups, and prior experience. Simon-Grifé et al. (2013) found higher risk perception among farmers compared to veterinarians; however, both groups prioritized certain biosecurity measures (e.g. measures aimed at limiting contamination by visitors of vehicle traffic to the farm). A study by Bennett and Balcombe (2011) in the United Kingdom found farmers with prior bovine tuberculosis (bTB) experience had high risk perception and were willing to pay a significant amount for a vaccine. Others found that perceptions of risk and the biosecurity measures, as well as additional factors influenced adoption of biosecurity measures. For instance, Toma et al. (2013) and Alarcron et al. (2013) found that perception of the efficacy of biosecurity measures, knowledge, experience, emotion, resources and trust influenced farmers' adoption of biosecurity measures. Trust and responsibility also emerged as factors influencing the adoption of biosecurity measures. Two studies reported that veterinarians were viewed as the most trusted source of biosecurity information (e.g. Alarcron et al., 2013; Garforth, Bailey and Tranter, 2013). A study by Gunn et al. (2008) found discrepancies in opinion of different stakeholder groups regarding responsibility for biosecurity measures in a study in the United Kingdom; veterinarians viewed farmers' lack of adoption of biosecurity measures as a major constraint to risk reduction, whereas farmers felt the government should play a larger role in biosecurity.

Table 11: Factors influencing biosecurity behaviours by farmers and within the farming industry.

Author(s), year	Geography	Main research questions	Research Design	Research Variables	Key Findings
Alarcron et al., 2013	United Kingdom	Explore (1) factors involved in decision-making process for disease control and (2) attitudes and perceptions of pig farmers regarding disease control.	infectious disease; pig farmers; FI; Theory of Planned Behaviour	RP: perception; BV: perceived behavioural control (PBC) OIV: attitudes and beliefs; subjective norms; trust; decision-making; information sources	Drivers for disease control pertained to resources and emotions (e.g. pig mortality, feelings of entering an economically critical situation, feelings of despair). Trust and knowledge of protective behaviours were also important (e.g. veterinarians viewed as most trusted information source, lack of knowledge of protective measures identified as a problem). Lack of awareness of producers of academic resources was identified.
Bennett and Balcombe, 2011	United Kingdom	Aims to explore cattle farmer's perceptions of severity of bTB and their willingness to pay for a vaccine.	Bovine Tuberculosis (bTB); cattle farmers; TI; Contingent Valuation and Choice Experiment	RP: risk perception; perceived susceptibility BV: willingness to pay OIV: vaccines; perceived effectiveness	Results recommend that all the cattle farmers interviewed perceived their farms at high risk for bTB infection and are willing to pay a substantially higher amount than the cost of the vaccine, which suggests farmers in bTB 'hotspot' areas perceive a net benefit from buying the vaccine. bTB was viewed as a 'political issue' with concerns over badger culling, and potential cost-sharing of vaccines with government. Information on badger culling pros and cons was viewed as confusing.
Garforth, Bailey and Tranter, 2013	United Kingdom	Explores the factors influencing sheep and pig farmers decision making regarding disease management for less well known diseases.	infectious disease; pig and sheep farmers; FI; theory not specified	RP: awareness; risk perception BV: disease management OIV: attitudes and beliefs; knowledge; experience	Perceptions and attitudes toward disease risk, protective measures/efficacy of measures/ability to perform measures, prior experience and credibility of information source were key factors driving decision making for disease management. Pig farmers were more concerned with wildlife control, training of staff and visitors than sheep farmers.
Gunn et al., 2008	United Kingdom	Main objective was to investigate and compare the different attitudes constraining improvement in biosecurity for cattle and sheep farmers, practicing veterinary surgeons and the auxiliary industries in Great Britain (GB).	infectious disease; farmers, veterinarians, relevant industry representatives; FI, TI; no specified theory	RP: perception; BV: investing in biosecurity OIV: efficacy of protective measures; responsibility	Results recommend that farmers believe other stakeholders, such as government, should contribute more to biosecurity. In contrast, veterinarians viewed their clients' unwillingness to invest in biosecurity to be a major constraint. Auxiliary industries were generally uncertain of their role in biosecurity, although many highlighted zoonosis as an issue and felt that most of the constraints operated at farm level.

Table 11 (continued): Factors influencing biosecurity behaviours by farmers and within the farming industry

Author(s), year	Geography	Main research questions	Research Design	Research Variables	Key Findings
Schemann et al., 2013	Australia	Explored factors associated with horse managers' perceived vulnerability to a future equine influenza outbreak.	Equine influenza; horse managers; MQ, TI; Protection Motivation Theory	RP: risk perception; threat appraisal BV: infection control; biosecurity OIV: motivation; perceived vulnerability; efficacy	Different groups across the horse industry perceived differing levels of vulnerability to a future outbreak of equine influenza. Those who had experienced infection on their farms, and those seeking information on infection control reported higher levels of perceived vulnerability to a future outbreak. Increased vulnerability contributes to favourable infection control behaviour and is important for understanding uptake of biosecurity measures.
Simon-Grifé et al., 2013	Spain	Surveyed Spanish pig farms to determine biosecurity measures currently in use, as reported by farmers, and to understand the perceptions of farmers and veterinarians regarding these measures.	infectious diseases; pig farmers and veterinarians; FI; no theory specified	RP: perception; awareness BV: biosecurity OIV: farm size	Farmers had higher perceptions of the biosecurity measures taken on their farms than the veterinarians did. Both farmer and veterinarians agreed that the most important biosecurity measures related to minimizing the risk of disease introduction to the farm though vehicles or visits. Medium- to high-density farms reported higher levels of biosecurity in comparison to lower density, more rural farms. Overall, biosecurity measures reported may be too low.
Toma et al., 2013	The Netherlands	Analyses the impact of a priori determinants of biosecurity on behaviour in Great Britain.	infectious disease; cattle and sheep farmers; TI; behavioural economics	RP: perception; BV: biosecurity OIV: demographics; networks; experience; farm type	Results recommend that numerous factors (e.g. perception and knowledge of biosecurity measures/efficacy and attitudes toward biosecurity; organic farm certification; networks (e.g. memberships in cattle/sheep health schemes); experience, and economic factors significantly influence behaviour.
Valeeva et al., 2011	United Kingdom	Explored farmers' perceptions toward disease risk and animal health management and factors underlying farmers' adoption of biosecurity measures and animal health programs.	endemic and epidemic animal diseases; Dutch fattening pig farms; MQ; Health Behaviour Model	RP: perception; aversion; severity; susceptibility BV: biosecurity; animal health programs OIV: cue to action	Results recommend that farmers value biosecurity measures over animal health management plans. In the behavioural model, perceived benefits in terms of strategy efficacy was the strongest direct predictor of strategy adoption. Endemic risks were perceived as less severe in comparison to epidemics. General self-protection (risk aversion) behaviour, directly contributed to farmers' decisions to show more specific farm-protection behaviour.

5.4 Summary: factors influencing biosecurity behaviour

The number of studies spanning risk perception and biosecurity concerns meeting the search criteria, or found through searching on the topics of preparedness and biosecurity more generally, was limited. However, from the studies reviewed here factors such as trust, prior experience with infectious disease, financial resources, and social factors such as attitudes and beliefs, impact biosecurity preparedness behaviours of farmers and those within the farming industry. Farmers generally had greater trust in veterinarians as reliable sources of information on biosecurity. Prior experience with infectious disease was positively related to preparedness in several studies. Networks (e.g. membership in cattle/health schemes), knowledge (e.g. of biosecurity behaviours and efficacy), attitudes and beliefs, and financial resources also played a role in preparedness decisions. Some studies found that higher density farms had more biosecurity measures in comparison to more rural, lower density farms.

5.5 Discussion: epidemics and pandemics

Risk perception studies focused on epidemics/pandemics have helped to understand what types of protective behaviours people are adopting or have the intent to adopt. This knowledge is useful for decision makers when considering how effective different intervention strategies may be.

There is a strong foundation of planning tools at the national and international level for the EU context to assist with preparedness planning for epidemics/pandemics. The National Risk Register and National Risk Assessment in the UK offer guidance for emergency planning and risk assessment. Furthermore, preparedness strategies and plans are in place for specific epidemics/pandemics such as influenza, as well as numerous other infectious diseases with the potential to impact both humans and animals. At the international scale, resources are also available through organizations such as the World Health Organization (WHO) and the United Nations (UN), which host tools for epidemic/pandemic preparedness planning and response. For instance, the UN has international regulations on all infectious diseases. The WHO provides toolkits for assessing health-system capacity for crisis management and “all-hazards” tools for hospitals to prepare emergency response plans.

Social factors and material risk factors are less examined in the literature on risk perception and preparedness for both human and animal infectious diseases. This may limit the understanding of social or cultural influences on risk management or social productions of risk. There is also a general lack of focus by many researchers studying hazards on preparedness for potential impacts on emotional wellbeing or mental health. As the case study of FMD illustrates, school closures, voluntary isolations, quarantines, animal culling, working on the front line, and the anxiety of not knowing when the outbreak would end, were among some of the many factors that caused trauma and other adverse emotional impacts for many members of the affected communities (Convery et al., 2008). While the impacts of disasters should not be assumed to be homogenous or negative, e.g. some may profit in some way from a disaster, where others may not, knowledge that epidemics/pandemics can cause significant emotional trauma for some should be considered when developing preparedness interventions.

Other concerns that did not emerge from the risk perception literature but which also have relevance to preparedness include topics such as food security and bioterrorism (e.g. use of an infectious

disease for terrorist purposes). Food security is a concern regarding some infectious diseases affecting animals, such as bovine spongiform encephalopathy (BSE), which can be contracted from eating the meat of an infected animal. Similarly, the introduction of an infectious disease through bioterrorism is a consideration for biosecurity and national security. Risk perception may play a role in an individual's behaviour as a consumer, for instance, regarding whether or not to purchase animal products during and outbreak. Similarly, farmers may be concerned about the marketability and thus, profitability, of animal products after the administration of a vaccine or other medications. These are possible topics to consider in future risk perception and preparedness studies regarding infectious disease.

5.6 Preparedness in practice: roles, responsibilities and epidemics/pandemics

Similar to natural hazards, a shift has been seen in health care preparedness from a focus predominantly centred on identification of health risk factors (e.g. largely risk assessment), to expanding analysis to encompass a broader range of social and environmental factors that also influence health such as attitudes, beliefs, and norms, as well as access to green space and other environmental factors that can influence health (e.g. a longer-term risk management approach).

This shift in conceptualisation is broadly referred to as 'health promotion,' which gained popularity in the early 1980s. In 1984 a set of health promotion principles was put forth by the WHO Regional Office for Europe (WHO, 1984) which were adopted in the Ottawa Charter two years later (WHO, 1986). This laid the foundation for a number of initiatives among a diverse set of stakeholders aimed at health promotion in Europe such as Healthy Cities, Health Promoting Schools, Health Promoting Hospitals, and recently, the Investment for Health approach for implementing health promotion (Ziglio, Hagard and Griffiths, 2000). Additionally, recent public health policy changes, for instance, in the UK, are encouraging 'health impact assessments'. Health impact assessments would evaluate how changes to public policy might impact health at the local level, considering factors including environment, housing, access to leisure, health and social care, education and other services and their potential impact on health (Ziglio, Hagard and Griffiths, 2000). The following section provides a brief overview of changes to the conceptualisation of health preparedness over recent decades, the resulting changes in roles and responsibilities of different stakeholders, and an overview of positive and negative trends in health promotion in Europe.

In the 1930s the idea of somatic diseases (e.g. diseases that originate in the mind) was revolutionary (Antonovsky, 1996). In the 1950s, a social ecology approach began to take hold in health related studies, introducing ideas such as 'life events'; classification of events found to negatively impact a person's health, such as divorce or a death in the family. In the early 1980s the health promotion model was introduced in the field of nursing and later revised in the mid-1990s (Pender, 2002). The health promotion model represented a shift toward a more holistic assessment of health. The health promotion model centred primarily on understanding a person's health beliefs to access better pathways to health (Pender, 2002). One main criticism, however, of the health promotion (e.g. health preparedness) approach is lack of a clear theoretical underpinning (Antonovsky, 1996).

Addressing the theoretical concerns of the health promotion model, the 'salutogeneic approach' to health promotion was presented by Antonovsky (1979, 1993). Essentially, Anotonovsky's approach recommends that the health profession has focused too much on identifying risk factors and

diagnosing disease, both of which are necessary tasks, however, are incomplete solutions for improving people's health. Anotonovsky recommended a focus on 'salutory' factors instead; where salutary factors refer to factors that are negentropic (e.g. increasing order with a corresponding decrease in entropy), e.g. they actively promote health. The salutogenic model, much like the social-psychological models applied in many natural hazard studies, is concerned with the relationship between health, stress, and coping (Antonovsky, 1996).

Changing roles and responsibilities: Health care professionals

- Since the mid 1990s the salutogenic model has promoted a more holistic view of health, e.g. taking into account 'salutory factors' (e.g. understanding the social and environmental risk factors that contribute to health) in addition to 'risk factors' (e.g. factors identified to increase disease risk). This may change the role of the health care practitioner with regards to level of communication required with patients and requiring a greater knowledge of the social and environmental risk factors for health.
- Health Impact Assessments, recently recommended in the UK, are a mechanism to consider the potential impacts of public policy on health at the local and national scale. Factors such as housing, environment, access to green space, leisure, health and social care, are considered as determinants of health.

Since shift toward health promotion, roughly the mid-1990s, Ziglio, Hagard and Griffiths (2000) outline the following positive and negative trends in health promotion for Europe:

Positive trends in health promotion: European Union

- An increased awareness for the need for a modern health care policy that better keeps with the principles and concepts in the Ottawa Charter and the Hyogo Framework for Action (HFA), which deals with disaster risk reduction
- Greater diversity in the number of stakeholders involved in health promotion activities such as schools and workplaces.
- Greater emphasis on intersectoral education between health care providers and stakeholders.
- Growing number of health promotion initiatives by bodies outside of the health sector, e.g. labour unions, education sector, voluntary organisations, self-help and consumer organisations, and industry.

Negative trends in health promotion: European Union

- The role of health promotion in health care reform policies has been minor in many member states.
- The budget allocated to health promotion is too small.
- In many member states, the institutional arrangements allotted for health promotion are weak or inappropriate.
- Several member states have established national and/or sub-national centres or agencies for health promotion, however most have remit that is too limited to enable them to be effective for implementing policy recommendations outlined in the Ottawa Charter.

- Programmes are often ad hoc, issue based, and too reliant on education as the primary means of implementation. Financial, infrastructure, and other development means for programmes are absent or too limited in many member states.
- Modern training in health promotion is available only in a small number of member states.

In summary, health care preparedness (e.g. health promotion) has undergone a similar shift from a risk factor/risk assessment approach, to a longer-term risk management approach considering the potential impact of social and environmental factors and processes on health. Similar to natural hazards, health promotion in the EU is currently limited by institutional capacity at the local level. Additional obstacles include financial support, infrastructure, training and the need for a more comprehensive mechanism for health promotion implementation, as currently education is the primary, or only, mechanism utilised. In contrast to natural hazards, more recent public health policy in the UK recommends a greater role for the government considering the potential health impacts of new policy. One such mechanism to do this is the introduction of health impact assessments.

6. Risk Perception and Preparedness: Terrorism

The following section on terrorism reflects a limited, but methodologically diverse and growing body of literature. It begins with an examination of the practitioner and academic definitions of terrorism before moving on to understand the unique characteristics of terrorism. It is then followed by discussions covering risk perceptions and communication before concluding with the literature on preparedness for terrorism. The section draws upon TACTIC Deliverable 4.1 focusing on the case study of terrorism in Europe (Anson, Watson and Wadhwa, forthcoming).

In contrast to natural hazards and epidemics/pandemics, both the definition and cause of terrorism are widely debated which makes preparedness for this type of risk more complex. This report draws upon the definition of terrorism as 'the calculated use of intimidation, coercion, direct violent action or the engenderment of fear to attain goals that are political, religious, or ideological in nature' (US NRC, 2002). However, it is acknowledged that there is no single meaning of the term terrorism (Butko, 2009). This section examines the variety of definitions and meanings associated with terrorism. First, more practitioner based definitions of terrorism are outlined before moving on to examine more academic perspectives of terrorism.

6.1 Key points for researchers and practitioners: terrorism

Knowledge/information

Key findings

- A key message that emerges from the social and political sciences literature surrounding terrorism are the central role played by specific language and discourse surrounding terrorist events.
- Lack of consensus on the definition of terrorism has precipitated challenges for preparedness.
- Some studies reported that respondents increased their knowledge of terrorism through information seeking as a preparedness measure.
- Some studies recommend that demographic variables influence a persons' fear of terrorism. Therefore, a single approach to prepare the public for terrorism may be inappropriate. This is an area of study where natural hazards may further benefit from.
- Some studies recommend that the way the media communicates terrorism risk can impact peoples' perceptions and fear of terrorism.
- Some studies have investigated how the content and language used for terrorism communication can influence event outcomes both positively and negatively, recommending the responsibility of those involved with communication to consider potential implications. Linking to other studies that have found that emotions such as fear and demographic variables such as gender or ethnicity may influence a persons' perception of terrorism, it is clear that these factors need to be responsibly considered for risk communication.

Key gaps

- Scenario planning for terrorism is complex and requires innovation in order to assist with preparedness training for emergency personnel. Furthermore, the role/expectations of the community are largely undefined in the preparedness literature.

Motivation

Key findings

- The use of specific discourse and metaphors should be an area of concern for risk communication with regards to terrorism, as there is the potential to impede understanding of the root cause of terrorism by adhering to a mainstream approach (e.g. assuming that terrorist acts are promoted purely by evil or malice may overshadow additional factors such as socio-economic and environmental conditions that might also be motivating factors).
- Risk perception studies on terrorism recommend that people do not prepare solely for terrorism, rather, preparedness is motivated by a variety of factors. Many people report becoming more vigilant as a result of greater awareness of terrorism.
- National sovereignty is linked to security, which poses a challenge to EU wide security policy changes for terrorism. There is a hesitance to share intelligence information widely for fear of leaks, which intersects with information and network concerns.

Key gaps

- Lack of understanding as to why people might be motivated to become terrorists.

Networks

Key findings

- Networks do not emerge in the risk perception literature on terrorism as a central theme. However, the disasters and hazards literature implies that networks may be of greater concern, as interoperability between actors may be a greater concern, for terrorism.

Key gaps

- The role of networks in terrorism preparedness has generally not been examined in the preparedness literature.

Resources

Key findings

- Some studies have found the impact on personal or psychological resources due to terrorist events to be more severe or traumatic compared to other hazard types. This suggests a need to better consider psychological preparedness as an element for terrorism preparedness and to guide relief efforts after an event.
- Resource limitations such as human and financial resources have been found to limit the ability to perform regular cross-border training exercises in the EU context.
- Interoperability of resources and communication obstacles have arisen as challenges for terrorism preparedness in some EU case studies.
- Physical infrastructure appears as a concern for many terrorism preparedness studies, though it is not evident what, if any, role the community plays in infrastructure related preparedness.

Key gaps

- Some studies have recommended poor social and physical resources as a motivator for terrorism, however, studies are needed testing this hypothesis.

Responsibilities

Key findings

- Some studies recommend a greater impact on personal (e.g. psychological) resources for survivors of terrorist events.

Key gaps

- The roles and responsibilities of different stakeholders regarding terrorist events emerged as a gap in the literature for preparedness.

Despite the notion of terrorism being over 200 years old, frequent changes in the meaning and nature of terrorism (Hoffman, 2006), have resulted in the lack of a universally agreed upon definition of the term (Primoratz, 1990; Toros, 2008; Butko, 2009). Practitioners charged with monitoring and classifying acts as terrorism therefore have a difficult task. The Global Terrorism Database (GTD), developed by researchers at the University of Maryland, catalogues terrorist acts and defines terrorism as an intentional act of violence or threat of violence by a non-state actor meeting the following criteria:

1. "The violent act was aimed at attaining a political, economic, religious, or social goal;
2. The violent act included evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) other than the immediate victims; and
3. The violent act was outside the precepts of International Humanitarian Law."(GTD, 2014)

Legally, the European Union (EU) agreed on a definition of terrorist offenses after the 11 September 2001 terrorist attacks in the US (9/11). The Framework Decision on Combating Terrorism adopted by the EU, aimed to provide a uniform legal framework for prosecuting terrorist acts across EU countries (Dumitriu, 2004). Thus, the definition of terrorism here refers to a set of commonly defined terrorist offenses and the rules of competence and legal cooperation between Member States to prosecute persons who have committed terrorist acts (ibid). Furthermore, three types of offences are distinguished: terrorist offences (Article 1), offences related to a terrorist group (Article 2), and offences linked to terrorist activities (Article 3). It should be noted that the terrorist offenses listed below for Article 1 must be legally evaluated as having the motives of 'seriously intimidating a population', 'compelling a government or international organisation to perform or abstain from performing any act', or 'seriously destabilising or destroying the fundamental political, constitutional, economic or social structures of a country or international organisation' (ibid):

Terrorist offenses listed under the Council Framework for Combating terrorism:

(a) Attacks upon a person's life which may cause death;
(b) Attacks upon the physical integrity of a person;
(c) Kidnapping or hostage taking;
(d) Causing extensive destruction to a Government or public facility, a transport system, an infrastructure facility, including an information system, a fixed platform located on the continental shelf, a public place or private property likely to endanger human life or result in major economic losses;
(e) Seizure of aircraft, ships or other means of public goods or transport;
(f) Manufacture, possession, acquisition, transport supply or use of weapons, explosives or nuclear, biological or chemical weapons, as well as research into, and development of biological or chemical weapons;
(g) Release of dangerous substances, or causing fires, floods, or explosions the effect of which is to endanger human life;
(h) Interfering with or disrupting the supply of water, power or any other fundamental natural resource the effect of which is to endanger human life;
(i) Threatening to commit any of the acts listed in (a) to (h).

Article 2 defines what constitutes a terrorist group and states that the person engaged in activities related to the terrorist group must have knowledge that his/her actions with such a group will be acknowledged as criminal activities. Article 3 covers activities such as forging documents in order to prepare a terrorist event. Some of these terrorist offenses, such as causing floods or using biological weapons (Article 1 (f,g)), could result in an epidemic/pandemic and therefore could potentially benefit from, or would at the very least engage, disaster risk managers and practitioners. Alexander (2003) notes many commonalities between terrorist events and natural and technological hazards, which could support the argument for terrorism to be managed by disaster practitioners.

There is little, if any, acknowledgement in the preparedness literature reflecting legal definitions of terrorism. Instead, the limited discussion that exists surrounds how terrorism could be, or should be, addressed as a hazard if it is to be included in the disaster management agenda. For example, in an

analysis of the impacts of 9/11, Peek and Sutton (2003) present evidence that existing conceptualisations of 'disaster' would require rethinking for terrorism. This is a result of:

- Patterns of racial profiling
- Violent acts and hate crimes towards individuals sharing physical characteristics or religious beliefs with the terrorists
- More severe mental health impacts for survivors compared to other hazard types (Norris, 2002)
- Strains placed on institutions coupled with heightened national security concerns that presented unique challenges in comparison to natural hazards

Adopting a more academic perspective, Butko (2009) identifies four main perspectives or paradigms on terrorism: (i) standard or mainstream, (ii) radical, (iii) relativist and (iv) constructivist. The standard or mainstream perspective, widely adopted by policy makers, intelligence analysts and academics, aims at describing and simplifying the conduct of specific individuals (Butko, 2009). Those committing terrorist acts are commonly framed as 'evil' and 'uncivilized' (White and Hellerich, 2003, p.728). As Butko (2009) notes, framing terrorists in this manner is not intended to understand or explain the motives of the terrorist or potential socio-economic roots of terrorism (Richmond, 2003, p. 298), rather, it is to promote the stereotype of terrorists as 'evil religious fanatics violently lashing out at a passive, sleeping giant of a democratic power' (Boggs, 2002, p. 257). Another characteristic of the standard/mainstream perspective of terrorism is the idea that 9/11 signalled the onset of 'new terrorism', which emphasizes the unethical and impractical nature of terrorism and commonly references radical Islam or 'Islamic Fundamentalism' (Butko, 2009). The 'radical' perspective of terrorism defines an act of terror as 'killing unarmed civilians' and based on this definition, the United States has been and remains the most prominent terrorist state in the world (Butko, 2009). Other uses of the term radical refer to the process of 'radicalisation' by which an individual, typically a Westerner, is converted or manipulated into adopting terrorist beliefs (Furedi, 2013). As the relativist perspective of terrorism draws on the other three perspectives, it is argued by Butko (2009) to be the least uniform. The relativist perspective emphasizes the ambivalent nature and usage of the term. The ambivalent nature of terrorism is argued to be intentional, rooted in the need to change and conform to the political needs and objectives of particular interests and groups (Jenkins, 2003; Butko, 2009). Supporters of the relativist perspective of terrorism highlight the historical ambivalence of the term, e.g. during the nineteenth century, the label terrorist was applied to anarchists, socialists, labour unions or other groups thought to threaten capitalism.

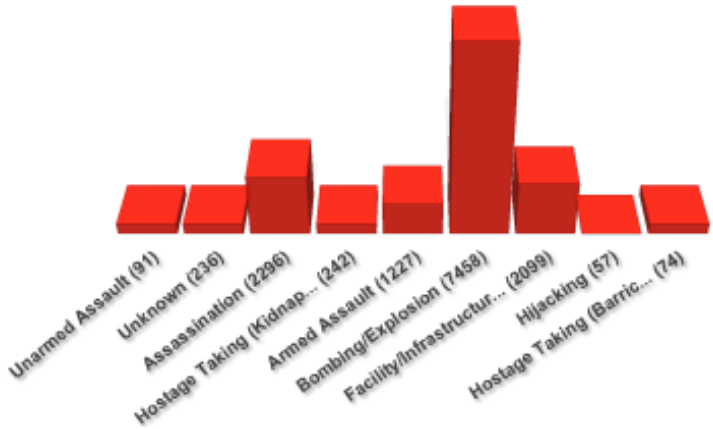
Today the mainstream use of the term terrorism refers largely to Islamic affiliations, with 80 per cent of 447 individuals or groups labelled as Specially Designated Global Terrorists (SDGT), by the United States, having Islamic affiliations (Bankoff, 2003, p. 422). Finally, the constructivist perspective on terrorism "contends that definitions, conceptions and classifications of terrorism are not objective and impartial, but ultimately 'constructed' to reflect the ideas, beliefs and, most importantly, geopolitical interests of the most dominant (i.e. hegemonic) powers" (Butko, 2009, p.190-191). Butko (2009) argues that the construction of terrorism is a process of communication rooted in language, which involves creating or imposing shared meanings. This issue will be explored further in the section on risk perception and communication.

6.2 The unique characteristics of terrorism

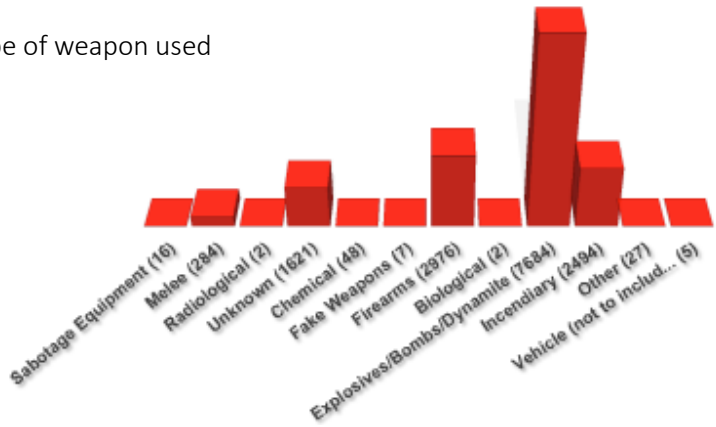
This section examines terrorism as a unique type of risk in order to provide a context for understanding why risk communication and preparing communities for terrorism requires additional considerations to those discussed in relation to planning and preparing for natural hazards (e.g. floods, earthquakes) and epidemics/pandemics.

As figure 4 below illustrates, terrorism can be enacted through a range of mechanisms, for instance, using bombs and explosives, firearms, radiological, biological, chemical or technological means, or other methods. Figure *ii* illustrates terrorism events as reported by the Global Terrorism Database (GTD, 2013) for Western Europe for the time period 1970-2013. As Figure 4 illustrates, the diversity of weapons, as well as the type of attacks, adds complexity to planning for preparedness. In April 2014, the UK Ministry of Defence outlined how the nature of terrorism could further change in the next 30 years and may involve cyber attacks, increased female participation and fatal viruses and robots being used as weapons (Ministry of Defence, 2014).

6i) Type of event



6ii) Type of weapon used



6iii) Number of deaths

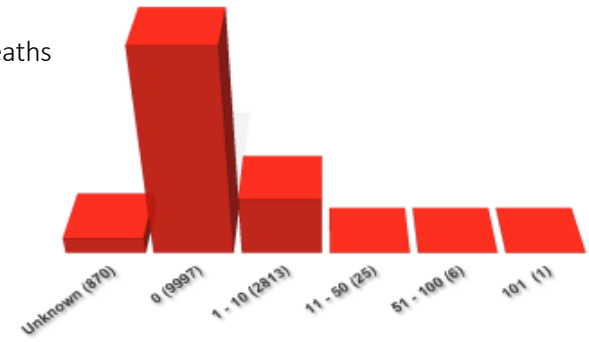


Figure 6: Statistics on terrorism events in Western Europe from the Global Terrorism Database: (top) type of event; (centre) type of weapon; (bottom) number of fatalities. For 'vehicle' category bombs carried in vehicles are excluded, as they are covered in the explosives/bombs/dynamite category. Source: National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2013). Global Terrorism Database. Retrieved from http://www.start.umd.edu/gtd

In contrast to the hazards examined above, terrorism is characterised by the intentional threat or act of violence. This "deliberate human malevolence" distinguishes terrorism from natural hazards (e.g. floods, earthquakes), technological hazards (e.g., toxic spills) and social hazards (e.g., riots) (Alexander, 2003, p.166). Torabi and Seo (2004) suggest that terrorist attacks such as 9/11 (2001) may be more devastating than natural hazards such as earthquakes due to the intention of terrorists to attack heavily populated areas.

The high uncertainty associated with terrorism is argued to make preparing for this type of risk more difficult. Uncertainty is concerned with situations where limited or absent scientific knowledge creates difficulties in terms of assessing and estimating risk (Klinke and Renn, 2012). For Kunreuther (2002) "when it comes to developing a strategy to reduce the risks of future terrorist activities…we do not know who the perpetrators are, what their motivations are, the nature of their next attack, or where it will be delivered. Hence it is extraordinarily difficult to know what protective actions to take" (p.662). Related to this, terrorism is also harder to predict than other hazards, in part because the act itself is intended to be unpredictable (Alexander, 2003). As historically, terrorist attacks have been less likely to occur than natural or technological disasters (McEntire, 2007) this may also prevent communities from preparing for this type of risk.

Related to terrorism being characterised by human intention, terrorism is intended to induce fear (Hoffman, 2006). The characteristics of terrorism, including that it is an unknown and ubiquitous threat, is argued to create a fear that is more intense and persistent in creating psychological conditions than other types of disaster (Bongar et al., 2007). Defined as the emotional response to an unusual incident (e.g. a threat), Durodié (2007) outlines how fear is influenced by a person's ability to understand a particular threat and the significance that they place on the threat. Consequently, studies have found that characteristics of a person influence their fear of future terrorist attacks. For instance, research conducted in the United States by Nellis (2009) and Lerner et al. (2003) found that females reported higher levels of fear of future terrorist attacks than men. The telephone survey of 532 New York and Washington residents by Nellis (2009) also found that for men, their perceived risk

of terrorism, being indirect victims and part of a minority group predicted terrorism fear. Research undertaken following 9/11 (2001) and the 2005 London bombings with residents of New York and London found that minority group status (e.g. being Hispanic or African American), having a low level of education or low income were related to fearing future terrorist attacks (Page et al., 2008; Boscarino et al., 2003). The findings of these studies indicate that a single approach to prepare the public for the risk of terrorism may be inappropriate. As demographic characteristics influence an individual's fear of terrorism, there is a need to tailor communications and preparedness approaches to respond to the fears of particular groups of the public. Highlighting how observing terrorism is also related to fear, Braithwaite (2013) outlines how "counter-terrorism polices simply must focus upon educating and reassuring the public about the real risk of terrorism" (p.99).

In line with the constructivist perspective of terrorism discussed above, the way in which the media has communicated the risk of terrorism to the public may have contributed to the fear generated. This argument is made by Altheide (2006) who outlines how "the politics of fear is buffered by news and popular culture stressing fear and threat as features of entertainment that increasingly are shaping public and private life as mass-mediated experience has become a standard frame of reference for audiences, claims makers and individual actors (Best, 1995)" (p.429). This argument is supported by a qualitative content analysis of newspaper coverage undertaken before and after 9/11 (2001), which found that 4 of the 5 newspapers examined increased the linkage between fear and terrorism by over 1,000% (Altheide, 2006).

Despite the unique characteristics of terrorism, there are "generic functions", such as communications, that are undertaken during the management of different types of disaster (Perry and Lindell, 2003, p.348). The United States Centers for Disease Control and Prevention (CDC) outlines how "emergency preparedness requires attention not just to specific types of hazards but also to steps that increase preparedness for any type of hazard" (i.e. a multi-hazard approach) (Office of Public Health Preparedness and Response, 2014). When communities adopt a multi-hazard approach to preparedness, this means that the public are also preparing for terrorism. However, as examined further in the following sections, the unique characteristics of terrorism mean that authorities do not only focus on community preparedness but also request the public's assistance in preventing future terrorist attacks.

6.3 Risk perception and communication for terrorism

This section on risk perception first examines responses to terrorist attacks before moving on to discuss how communication by the media and authorities can influence community perceptions of terrorism and enable communities to increase their preparedness to respond to future terrorist attacks. Thus, communication can potentially reduce the effects of future terrorist attacks, such as those outlined below.

An objective of many hazard related risk studies in the field of psychology is to identify specific responses (e.g. predictors) to a hazard situation that may result in adverse mental health effects for the individual over the longer-term. These predictors could then be applied to identify vulnerable individuals and guide them to appropriate treatment options. Several risk perception studies for terrorism (Table 12) can be categorized under this objective. Perievent panic (PEP) attacks, panic attacks occurring close to the timing of the event, have been shown in some studies to be predictors

for later mental health status, including the onset of depression (Goodwin, Brook and Cohen, 2005; Goodwin and Hamilton, 2002; Lawyer et al., 2006; Adams and Boscarino, 2011). Adams and Boscarino (2011) examined PEP as a predictor for post-trauma depression in survivors after the 9/11 terror attacks in the US. Results showed that PEP was not a predictor for post-trauma depression. However, pre-event mental health status, being female, and lower socioeconomic status were factors increasing an individuals' susceptibility to PEP during a trauma event.

A European study conducted by Grimm et al (2014) examined emotional, behavioural and cognitive responses during disasters. While the study was not focused explicitly on terrorism, terrorism was one of the hazard events examined. Results recommended that fear and a feeling of being at high-risk were the most common emotions experienced during disasters. Survivors largely engaged in adaptive and helping behaviours including search and rescue. While panic was also a commonly reported emotion during the event, it was described as an elevated feeling of fear, and not 'mass panic' behaviour. Similar to Boscarino and Adams (2011), this study examined the relationship between mental health and exposure to the event, finding respondents with higher post-traumatic stress reported greater feelings of dissociation or derealisation (i.e. seeing other people and the surrounding environment as unreal) and psychological reactions compared to those reporting lower post-traumatic stress. Survivors also reported difficulty recognizing environmental cues, such as smoke or ground shaking, to alert them of what was happening. Many also reported underestimating the seriousness of the situation, most frequently with longer-onset events such as flooding.

Other studies that have reviewed the disasters literature spanning several hazard types, such as Norris et al (2002), have identified that survivors of mass violence events, e.g. terrorism or shooting sprees, were more likely than survivors of other natural or technological hazards to suffer adverse impacts. Norris et al (2002) found that specific psychological problems, nonspecific distress, health problems, chronic problems in living, resource loss, and problems specific to youth were the most frequent disaster impacts. Additionally, youth were more likely to be adversely impacted in comparison to adults, as were those in developing versus developed regions, and finally, survivors of mass violence events compared to natural or technological hazards were more likely to be impaired (e.g. characterised by one of the previously mentioned categories such as distress or health problems). Severity of exposure, female gender, middle age, ethnic minority status, secondary stressors, pre-event psychiatric problems, and weak or deteriorating psychological resources represent factors that are more likely to lead to adverse impacts for adults. For youth, family factors and family context held the greatest influence on disaster outcomes, however, personal psychological resources and personality also played a role.

Similar to healthcare professionals in epidemics/pandemics, willingness to work of emergency management and medical personnel during a terrorist attack is a preparedness concern. Smith (2012) examined first responders of the 9/11 terror attacks risk perception and willingness to work during a terror event. Willingness to work was directly influenced by risk perception, that is, higher risk perception negatively impacted willingness to work. While all respondents reported a willingness to work in future hazard events, several key concerns for preparedness planning emerged regarding Personal Protective Equipment (PPE), trust, roles and responsibilities, and communication. Respondents were concerned most about injury/death, risk of contamination and exposure; situations they did not feel were adequately conveyed by their employers during 9/11. Distrust in

employers ability to provide accurate and timely information on the hazard, as well as need for assistance with childcare and eldercare obligations during the event need to be addressed for future preparedness planning.

In contrast to personnel who may be unwilling to work during a terrorist attack, research following 9/11 highlighted how organisations were "overwhelmed by volunteer demand" (Lowe and Fothergill, 2003, p.293). Qualitative research undertaken by Lowe and Fothergill (2003) immediately following 9/11 found that members of the New York City community volunteered in a variety of response activities including "translating for families, delivering and moving supplies, removing debris, cheering for rescue workers, helping with crowd control, donating blood, counselling, preparing and serving food, fundraising, and giving massages to rescue workers" (p.296). Related to volunteerism during disasters, Lichterman (2000) discusses the "community as resource" strategy for responding to disasters. He focuses on community based training programs which are categorised as "soft mitigation" and that are associated with emergency preparedness and activities designed to reduce the effects of natural disasters (p.264). Community preparedness programs can therefore encompass training that enables the public to become part of the official response to both natural and human-made disasters.

Reviewing the literature on the responses to terrorist attacks highlights the importance of preparing communities in advance so that they are able to cope with the psychological impacts of future terrorist attacks. For instance, a study by Peek and Sutton (2003) highlights how survivors of terrorism may suffer more severe mental health impacts in comparison to other hazards and recommends the need to place greater emphasis on mental health resources for preparedness planning. Communication is also critical in terms of influencing risk perceptions and preparedness for terrorism. However, as examined below, the ways in which communication is used can also have negative implications. The ways in which the media report on terrorist attacks can impact upon community perceptions of terrorism, which may influence their preparedness and ultimately how they respond to future terrorist attacks.

Terrorism involves a process of communication (Butko, 2009), where the language, perspective, and participation of different actors may have additional adverse effects. In planning for preparedness for terrorism, therefore, communities should be aware of the potential repercussions of the language and methods used to communicate the risk of terrorism and representations of terrorism that they engage in. The language which is used to describe terrorists can have cascading effects within the community, for example, hateful or discriminatory language may incite racial profiling and hate crimes against individuals sharing similar physical, religious or other characteristics with those labelled as terrorists. For example, a study by Peek and Sutton (2003) found that people sharing religious beliefs or sharing physical characteristics similar to the 9/11 attackers were subject to racial profiling, hate crimes and violent acts throughout the US after the crisis. This could be an illustration of a negative cascading effect of labelling terrorists as 'evil' and predominately Islamic. While this hypothesis remains untested, the evidence for discrimination post-9/11 is quantifiable, recommending the need for preparedness to consider racial profiling and discrimination as a cascading effect of terrorism. Additionally, the language used to describe the terror event may enable certain actions such as criminal punishment. For instance, if it is portrayed as an act of war versus a criminal act, different laws and expectations are engaged.

Hüssle and Spencer (2008) also provide examples of how the language used in the discourse on terrorism may enable different actors to undertake specific actions. The authors examine the metaphors used in the narrative of Al-Qaeda in the German popular press following three separate terrorist events, e.g. the 9/11 attacks (2001), Madrid train bombings (2004), and the London bombings (2005). The authors illustrate how Al-Qaeda was first constituted as a war, but from 2004 onwards the principal metaphor shifted from war to crime, constructing Al-Qaeda as a criminal rather than a military organisation. This shift in construction transformed Al-Qaeda from an external, legitimate actor to an internal, illegitimate actor whose actions were legally punishable, shifting counter-terrorism practices from a military to a legal process (Hüssle and Spencer, 2008). In this manner, the shift in the terrorism narrative enabled actions by the government. This example, meant to be illustrative and not comprehensive, demonstrates the complexity surrounding the language and construction of narrative regarding terrorism.

Another consideration for preparedness regarding terrorism and communication is in understanding the role that citizens play in generating additional publicity of the event. Watson (2012) analysed images, video, and comments submitted to the BBC news service regarding the London bombings. Some key results from the study recommend that dependent citizen journalists played a role in reporting events following the terrorist acts on 07/07, which added to the publicity of an act of terror. The additional publicity by citizen journalists can contain new, distinctive, and more dramatic publicity than what is presented in traditional media; thereby it serves to extend terrorism publicity. Content tends to be extremely personal, intimate, and visually graphic. Terrorists themselves, by creating martyrdom videos, may also participate in citizen journalism. Positive outcomes are seen from dependent citizen journalism as well, such as highlighting the resilient and calm nature of Londoners in their response to 07/07. This type of publicity may not have the desired effect of the terrorists, but instead offers a way for the public to fight back.

Communication regarding terrorism is important from the perspective of who engages and how; citizens can have positive or negative influences on terrorism publicity depending on the manner in which they engage in citizen journalism. Citizens can positively influence future preparedness, and potentially even prevention, by not giving terrorists acts added publicity, but instead focusing on resilience and the positive behaviour of citizens and victims of terrorist acts. Government and media can negatively influence preparedness for terrorism by engaging in standard/mainstream discourse that does not focus on the root cause of terrorism and thus, cannot inform prevention. For community preparedness, engaging the general public and local authorities in a discussion on potential implications of language and communication, may improve terrorism preparedness. However, there is a gap in understanding the perspectives of the various actors engaged in disaster response, as well as the general public, on the potential repercussions surrounding the language and communication used for terrorism and its implications on preparedness. This is a potential area of opportunity for TACTIC to examine through the four case studies.

6.4 Preparedness for terrorism

Terrorism is increasingly recognised as a global threat that should be prepared for (Lemyre et al., 2006). This section will focus on the efforts that have been made by governments to communicate with the public regarding terrorism. It will examine how for terrorism, rather than focusing on

preparing communities for future terrorist attacks, governments and authorities advise the public to be vigilant and also request the public's assistance in preventing future attacks.

The Australian and UK governments have held national campaigns addressing terrorism. In 2003, following the October 2002 Bali bombings, the Australian government launched a 'National Security Public Information Campaign' specifically addressing the risk of terrorism (Mcdonald, 2005). The campaign involved sending a terrorism kit, including a fridge magnet detailing crisis telephone numbers and guidance for spotting terrorists, to all Australian households at a cost of $15 million (Banham, Delaney and AAP, 2003). In addition to providing information on how the government was preparing to respond to future terrorist attacks, the kit outlined what the Australian public "could do to identify, and respond to, potential terrorist incidents" (Mcdonald, 2005, p.171). In addition to preventing terrorist attacks, a booklet disseminated with the kit provided preparedness actions that the public could undertake including assembling an emergency kit, determining a meeting place and making a list of important telephone numbers (Walsh, 2003). There has been debate surrounding the purpose and response to the kits. For instance, it has been argued that "the kit was a representational strategy aimed at justifying and furthering support for particular security conceptions and practices" (e.g. anti-terror legislation) (Mcdonald, 2005, p.186). Tilley (2004) further highlights the wide variety of views on the kits including them being seen as saving lives, awareness raising, alarmist and vilifying Muslims. The diversity of perspectives on the terrorism kit highlights the challenges of attempting to prepare communities for this type of risk. Whilst research has not examined the influence of the Australian campaign on risk perceptions and preparedness, Gleeson (2014) highlights how a request by Brisbane Lord Mayor Jim Soorley for the public to return the kits to government as they were a form of propaganda, resulted in 150,000 kits being returned.

In the UK in 2004, the "Preparing for Emergencies: What You Need to Know" booklet was sent to every household by the government as part of a £8.3 million campaign (Kearon, Mythen and Walklate, 2007). Whilst the booklet did not focus solely on terrorism, both the media and political attention addressed the content covering terrorism (Kearon et al., 2007). For instance, the Guardian promoted the booklet with the headline; "Terrorism: advice for every household" (Barkham, 2004). Whilst the booklet provided the public with information on how they could prepare for emergencies, the two pages covering terrorism focused on preventing a terrorist attack by reporting suspicious activity to the police (HM Government, 2004). The public's perceptions of the booklet as a risk communication tool, and the impact of the booklet on public risk perceptions and behavioural intentions were investigated by Kearon et al., (2007). The key findings of the research, involving a questionnaire completed by 116 people, include:

- The booklet not being received by a quarter of the sample and of those who had received it, 31% had not read it
- Whilst 67% found the booklet informative, only 54% found it useful
- Although 59% felt the same level of risk before and after reading the booklet, 34% reported feeling more at risk as they believed that the government had knowledge of a future attack
- A higher percentage of women than men reported feeling more at risk and fearful after reading the booklet
- The percentage of people reporting feeling at risk and fearful decreased with age

- A higher percentage of British Asian respondents than White British respondents felt less at risk and less fearful after reading the booklet
- 68% did not act on the information provided, with only 3% having prepared the recommended items (e.g. bottled water)
- 66% reported distrusting government communications on terrorism due to a lack of credibility concerning previous communication (e.g. on Iraq and weapons of mass destruction) and due to government's ability to manipulate information
- Only 19% felt that the government's strategy for communicating the risk of terrorism had been effective, with only 5% agreeing that the government had been open in its communications concerning terrorism
- Differences in perceptions of the government's strategy for communicating about terrorism were found across gender, age and ethnicity highlighting how different strategies are required for different groups of the public

The findings of the research highlight how:

> "[A] "one size fits" all approach to communicating the terrorist risk should not be the sole strategy implemented by a government wishing to raise awareness of national security issues. In order to respond to the assorted proclivities of different communities in the U.K., risk communications should be tailored to meet the needs of particular stakeholder groups. To this end, utilizing a variety of interactive communication formats – including workshops, public meetings and citizens' panels – might be employed to build up public trust and co-operation" (Kearon et al., 2007, p.93).

The campaigns by both the Australian and UK governments encompassed requests for the public's assistance in preventing terrorist attacks. Part of prevention, is also the request for the public to be vigilant and report any suspicious behaviour or activity. Larsen and Piché (2009) discuss examples of public vigilance campaigns in New York City, Ottawa and London, which suggest to the public that not being vigilant is an irresponsible and risky strategy. In contrast to the other hazards examined above, terrorism also incorporates the concept of vigilance.

Studies by Kano et al. (2011) and Bourque et al (2012) evaluated motivations for household preparedness for terrorism and other disasters (Table 12). Kano et al (2011) report results from a national survey in the USA aimed at assessing people's experience, perceptions, preparedness, mitigation, and avoidance behaviours surrounding terrorism and other disasters. When asked specifically about terrorism, the majority of respondents said that they have become more vigilant and learned more about terrorism, but not engaged in other preparedness activities. Perceptions of trust in officials showed that a majority of respondents viewed local fire fighters, state health care, and the National Center for Disease Control as being more honest and trustworthy by providing more adequate information compared to other state, local, and government agencies. The majority of respondents reported they were more likely to engage in certain avoidance behaviours because of terrorism such as avoiding mass transit, high-risk destination areas, or changing their mail handling behaviour; similar results were found by Torabo and Seo (2004). The authors conclude that terrorism itself may not motivate people to prepare, as it is viewed as a high-consequence, but low-probability event. In another national US survey, Bourque et al (2012) found that male respondents and

individuals with higher-income were more likely to report preparedness activities in Washington, DC and New York City, after 9/11 whereas African Americans, Hispanics, and lower income individuals reported more avoidance activities. Overall, motivation for preparedness did not stem solely from 9/11, but from a combination of factors.

In addition to the studies examining preparedness for terrorism, this literature review has highlighted a number of important considerations regarding community preparedness for terrorism, including:

- Understanding the implications of different definitions and perspectives of terrorism and what this means in terms of classifying attacks as acts of terrorism
- The way in which governments communicate the risk of terrorism may result in communities being unprepared for this risk. For terrorism, governments have focused predominantly on prevention by requesting that the public be vigilant, rather than specifically preparing for, terrorism. Thus, consideration needs to be made on the relationship between prevention and preparedness.
- The implications of how the media and governments communicate the risk of terrorism and how this influences community preparedness
- Identifying how the unique characteristics of terrorism (e.g. human intent, uncertainty) could be addressed when preparing communities for terrorism
- Developing different preparedness strategies to target different groups of the public
- Planning to account for responders who may be unwilling to work during a terrorist attack and an overwhelming amount of public volunteers
- Considering how the psychological impacts of terrorism can be addressed with preparedness approaches during the planning stages

6.5 Summary: factors influencing risk perception and preparedness for terrorism

Risk perception studies on terrorism are limited in comparison to other hazard types. Available studies, however, recommend that factors such as trust, knowledge, information, responsibilities, influence individuals preparedness intentions or behaviours. Among specific types of respondents, higher risk perception related to a lower willingness to work for first responders of the 9/11 terror events. Trust in authorities and in the accuracy and timing of information also influenced willingness to work for first responders. Both first responders and the general public showed preferences for which authorities they viewed as most trustworthy with predominately local and state actors viewed as more trustworthy compared to national government authorities. Other factors such as personal protective equipment and having childcare/eldercare responsibilities were also influential on willingness to work for first responders.

A greater likelihood to engage in avoidance behaviours such as avoiding mass transit, high-risk areas, or public transportation because of terrorism was reported in several studies. Other preparedness behaviours reported were becoming more vigilant and learning more about terrorism. A common misperception about behaviour during terrorist events is that mass panic will result (Alexander, 2003). Several studies reviewed here support that assertion, with reported feelings of panic described as an elevated sense of fear and more helping or protective behaviours being reported during disasters.

Studies emerging from the psychological literature recommend that personal resources, social factors and norms, age, gender, and resources are important factors influencing post-event impairment. The weaker a persons' personal resources, being female, being of a specific age range (e.g. youth or middle aged), having more psychological problems before the event and being more exposed during an event, are all factors that increase the likelihood that a person will be impaired as a result of a disaster event. Youth, those from developing countries, or those experiencing mass violence (e.g. terrorism or shooting sprees) were more likely to be impaired by the disaster event.

Table 12: Terrorism risk perception and preparedness intentions and behaviours. Research Design (hazard type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Author(s), year	Geography	Research Design	Research Variables	Key Findings
Adams and Boscarino, 2011	USA	Community residents, TI, Diagnostic Interview Schedule (DIS) and perievent panic measure used to develop survey	RP: perception; BV: perievent panic attacks and later onset depression; OIV: psychosocial resource; pre-disaster psychological status; post-disaster life events; gender; area of residence	Pre- and post-disaster variables are needed to explain the complex causal pathways between psychological status, stressor exposure, perievent panic (PEP) attacks, and depression onset after the 9/11/01 terrorist attacks. PEP attacks did not predict post-trauma depression. Women or those with pre-existing mental health problems are more likely to experience PEP, and the wealthy are least likely. Demographic factors and pre-trauma mental health factors influence exposure to a traumatic event, increasing the likelihood of PEP onset, which is associated with lower psychosocial resources and increases in stressor events, leading to later depression onset.
Bourque et al., 2012	USA	Household residents, TI, Theory not specified	RP: perception; BV: preparedness; avoidance; OIV: exposure to risk during 9/11; gender; age; ethnicity; income	This study sought to identify whether households engaged in preparedness or avoidance activities since the 9/11/01 terrorist attacks in the US. Overall, few households were motivated solely by terrorism to take protective/avoidant actions. Residents in higher-risk areas for terrorism (NYC and Washington, DC), men, and higher-income individuals reported more preparedness activities. Lower-income respondents, African Americans and Hispanics reported more avoidance activities.
Grimm et al., 2014	Czech Republic, Germany, Poland, Spain, Sweden, Turkey, UK	Disaster survivors within last 10-yrs; FI/FG; Impact and Event Scale-Revised survey (assess post-traumatic stress symptoms); questions related to risk perception, emotional- and cognitive processing	RP: perception; BV: behavior during event; OIV: emotional and cognitive responses to event; environmental cues	Explores survivors' emotional, behavioral and cognitive responses during disasters. Results recommend that most frequently experienced emotions during disasters (in this study: building collapse, earthquake, flood, terrorism) may be adaptive and non-selfish, e.g. to fear life threatening stimuli and look for ways to avoid or limit negative exposure. The next most commonly reported behaviors were preparing for evacuation and information seeking. Fear and a feeling of being at high risk were the most commonly reported emotions. Panic was also commonly reported, but as an elevated feeling of fear and not mass panic behavior. Environmental cues of the disaster were commonly misinterpreted; in one-half of interviews, people reported misinterpreting environmental cues. Underestimation of the seriousness of the event was primarily reported for flooding. Those with higher post-traumatic stress reported greater feelings of dissociation/derealisation and psychological reactions compared to the low post-traumatic stress group.
Kano et al., 2011	USA	Residents in higher terrorism risk areas (DC, NYC, Los Angeles) and lower risk areas (rest of US); TI; Theory not specified	RP: perception; awareness; BV: preparedness; mitigation; avoidance; OIV: trust; demographic variables	A national survey to assess individuals' experience with, preparedness for, and perceptions of terrorism and other disasters was conducted. Results recommend the majority of respondents have become more vigilant and educated regarding terrorism post 9/11. 1/3rd of respondents reported duplicating important documents, stockpiling supplies, and developing emergency plans. Motivations to do so, however, stemmed from a variety of reasons. When asked specifically about terrorism, respondents replied they have become more vigilant and learned more about terrorism, but had not engaged in other preparedness activities specifically for terrorism.

Table 12 (continued): Terrorism risk perception and preparedness intentions and behaviours. Research Design (hazard type respondents, Survey delivery method, Theory, MQ = mail questionnaire; OQ = online questionnaire; FG = focus group; FI = face-to-face interview; TI = telephone interview. Research variables (Risk perception [RP] Behavioural variables [BV], Other important variables [OIV]).

Authors, year	Geography	Research Design	Research Variables	Key Findings
Norris et al., 2002	29 countries; 29% from UK, AUS, Western Europe, Japan	Codified results of extensive literature review; natural and human-made hazards; Theory not specified	RP: risk factors; BV: psychological problems; nonspecific distress; ways of coping OIV: age; health problems; problems in living; life events; problems specific to youth; social and psychological resources	Samples from the disasters literature from 160 studies across 29 countries were coded as to sample type, disaster type and location, outcomes of risk factors observed, and overall severity of impairment. In order of frequency, outcomes observed were specific psychological problems, nonspecific distress, health problems, chronic problems in living, resource loss, and problems specific to youth. Survivors of mass violence, e.g. terrorism or shooting sprees, were more likely to be impaired compared to survivors of natural or technological hazards. Adult survivors experiencing more severe exposure, of the female gender, being middle aged, being ethnic minority status and those pre-event mental health problems and other stressors were more likely to experience adverse effects. Family context such as family violence, family structure, preexisting health/mental conditions were found to influence younger adults, as well as individual personality and personal resources.
Smith, 2012	USA	First responders and emergency medical technicians; FG/FI;	RP: perception; BV: willingness to work during terrorist event OIV: personal safety; duty of care; trust (in information provided by employers); childcare and eldercare responsibilities	This study aimed to gain an understanding of first responders risk perception and willingness to work during a terrorist situation. Willingness to work was directly influenced by risk perception (e.g. high risk perception negatively impacts willingness to work), which may change over the course of a disaster. Willingness to work in future terror or bio-terror situations related to improving: Personal Protective Equipment (PPE), communication strategies, and the development of targeted and specialized training and education programs. Responders were concerned most about injury/death, risk of contamination and exposure. Distrust in employers' ability to provide accurate, timely information about the event was commonly reported. Childcare and eldercare responsibilities were also reported by many response workers as needs to address for preparedness planning.
Wood et al., 2012	USA	Residents; TI; Diffusion theory	RP: perception; awareness; BV: preparedness actions taken OIV: preparedness information; preparedness 'mediating variables'; risk area; demographic variables	This study presents an 'information to action model' recommending reporting 'actionable risk' (what to do about a risk) instead of about the risk itself to motivate preparedness. Results recommend that actionable risk information received (density and content) and actionable risk information seen (cues) about preparedness actions are the key factors that motivate people to prepare. Intervening factors (knowledge, perceived effectiveness, discussing behaviour with others) also act to increase preparedness.

More recently, discussions have emerged surrounding a potential terrorism prevention measure in the UK, with Prime Minster David Cameron considering blocking the return of UK citizens suspected of engaging in terror activities. Previously, the range of powers for seizing passports pertained only to foreign nationals, dual nationals, or naturalised citizens (BBC, 2014).

Wood et al (2012) (Table 12) recommend a shift in risk communication from the risk itself to placing more emphasis on the preparedness actions, e.g. what to do about the risk. Testing a model of 'information-to-action', preparedness information variables (e.g. content, density, and observation), preparedness mitigation variables (e.g. knowledge, perceived-efficacy, discussing information with others, e.g. milling) and preparedness actions taken were modelled. Results recommend that communicating actionable risk, observing preparedness actions that others have taken, and receiving information about preparedness actions, play key, though different roles, in motivating households to prepare. Actionable risk information received, both in terms of density and content, and actionable risk information seen or cues about preparedness actions are the key factors that motivate people to prepare. In other words, the more people hear, read, and see about getting ready, the more they do to get ready (Wood et al., 2012). Intervening factors (knowledge, perceived effectiveness, and milling, e.g. discussing behaviour with others) also act to increase preparedness.

A gap in the hazards and disaster management literature is a lack of consideration of risk communication needs specific to terrorism. Recent works in the social and political sciences that have generated awareness of this concern can inform this gap. For example, the literature has focused on understanding the motives of labelling an event as a terrorist event and the actions this could enable by Governments or other actors (e.g. Butko, 2009), exploring how the language and metaphors used in terrorism discourse can impact outcomes (e.g. Hüssle and Spencer, 2008), and on understanding how activities such as citizen journalism can influence outcomes of terrorist events for different stakeholders (e.g. Watson, 2012). The papers reviewed below illustrate how risk communication can have a critical impact on terrorist outcomes and that the language used in risk communication and preparedness efforts may have implications that merit greater consideration.

In comparison to natural hazards, studies on risk perception and preparedness for terrorism are limited. This could be due to a range of reasons stemming from how terrorism is defined, the nature, frequency, or timing of terrorist events, as well as how the risk of terrorism is communicated. The limited studies addressing terrorism may also be because it is only since 9/11 (2001) that increased attention has focused on household preparedness for terrorism (Kano et al., 2011).

6.6 Preparedness in practice: roles and responsibility for terrorism

EU governments agree that terrorism is a serious threat to global security, as can be evidenced by the identification of terrorism as one of five key threats to European security outlined in the European security strategy of 2003, along with weapons –of-mass-destruction, regional conflicts, state failure and organised crime (European Council, 2003; Keohane, 2008). In the wake of terrorist attacks in the US in 2001, Madrid in 2005, and London in 2007, many EU politicians have encouraged greater European co-operation in fighting terrorism (Keohane, 2008). The first section addresses primary changes to EU policy for counter-terrorism highlighting changes to the roles and responsibilities of different actors, as well as obstacles that have emerged. The second section provides a more detailed case of EU policy for addressing chemical, biological and radiological (CBR) threats.

Firstly, it is important to note the inherent complexity with understanding the motive for terrorism, e.g. what are the main goals of dominant terrorist groups, what prompts people to join them, what other external and internal factors may be contributing to terrorism? The International Institute for Strategic Studies has estimated that there are roughly 18,000 al-Qaeda trained terrorists globally (IISS, 2004; Keohane, 2008), yet there is no consensus on the motives, or potential external and internal factors encouraging terrorism. Are al-Qaeda terrorists driven by the goal of establishing a Muslim caliphate? Or is it possible that some are responding to local grievances, such as corrupt pro-Western regimes in countries such as Egypt, or a perception that EU governments are anti-Muslim (Keohane, 2008)? It could be that terrorism is motivated by one, all, or some combination of these factors and others (ibid). As the European Security Strategy states 'Europe is both a target and a base' for terrorism (European Council, 2003).

Second, it is important to state that local police and national intelligence officers carry out most of the counter-terrorism work within the EU such as infiltrating cells and arresting suspects. Governments typically handle cross-border investigations at a bi-lateral level, instead of at the EU level, although Europol's (the EU law enforcement agency) role in cross-border investigations has significantly increased in recent years (Keohane, 2008). A key challenge that emerges is that National intelligence agencies are unwilling to share information with more than one other country, for fear of security leaks (ibid).

Third, it is important to note that some countries within the EU have co-operated more closely than others, so roles and responsibilities for preparedness for counter-terrorism may differ. For example, smaller groups of governments have come together to collaborate more closely on joint investigations and persecutions of terrorists. Examples include a Memorandum of Understanding between Belgium, Luxemborg, and The Netherlands in 1996, the establishment of a combined count-terrorism unit between France and Spain in 2004, the long history of collaboration between the British and Irish governments on matters pertaining to the Irish Republican Army (IRA) terrorists, additionally the Treaty of Prüm in 2005, signed by Austria, France, Germany and Spain, contains a number of innovations, such as sharing DNA and fingerprint data, and common rules on aeroplane security (Keohane, 2008, p. 128). Additionally, transatlantic government-to-government counter-terrorism co-operation has deepened, despite EU concerns over US counter-terrorism tactics, such as torture of prisoners (ibid).

Based on these three points, it would appear that the EU is committed to facilitating a stronger counter-terrorism approach; however intentions do not always translate into actions. Keohane (2008) identifies a paradox in EU's role in counter-terrorism:

'There is a paradox in the EU's role in counter-terrorism. On one hand, governments agree in principle that co-operation at the EU level is a good thing because of the cross-border nature of the terrorist threat. On the other hand, they are slow to give the Union (EU) the powers (such as investigation and prosecution) and resources (such as spies and money) it would take to be truly effective." (Keohane, 2008, p. 129)

Key reasons for the EU's hesitation to enacting stronger collaborations pertain to national sovereignty, scope of policy, and the significant effort required for coordinating 27 governments at

the EU level. Security policy by its nature is intertwined with national sovereignty. 'Counter-terrorism' itself is not a defined policy area, yet it requires cooperation and action from a number of different government departments. For example, finance ministries should track terrorist funding, health ministries should stockpile vaccines and environment ministries should protect infrastructure (Keohane, 2008).

Some concrete changes to EU counter-terrorism policy are visible through the Counter-Terrorism Strategy, which was adopted in December of 2005. The Strategy provides a typology for the actions listed in the EU counter-terrorism Action Plan, agreed upon in 2004, under four headings: prevent (addressing the root causes of terrorism); pursue (using intelligence to apprehend terrorists); protect (security precautions); and respond (emergency response).

New roles and responsibilities for EU countries have emerged

- Actions for European police co-operation
- Anti-money laundering and asset-freezing laws
- Transport and border security arrangements
- Additional measures to help Member States' protect vital services such as health, food and water supply in the event of a terrorist attack

However, serious obstacles that have emerged regarding new measures include ensuring that EU Member States implement EU agreements, such as the common arrest warrant, that Member States co-ordinate police actions efficiently, and more importantly, that resources are not sufficient to support the EU in playing a 'meaningful role in counter-terrorism' (Keohane, 2005; Keohane, 2008). Additionally, inter-institutional rivalries and inter-institutional sensitivities have hindered EU's counter-terrorism progress, as they have resulted in delays in legislation and for co-ordinating EU counter-terrorism efforts (Keohane, 2008).

Other challenges, beyond political and institutional co-operation, pertain to the potential for negative effects of counter-terrorism policies on the Muslim population in the EU. Presently, there are 15-20 million Muslim citizens in the EU, but if Turkey joins the EU, this number will exceed 100 million (Keohane, 2008, p. 136). There is 'strong evidence that al-Qaeda operatives in Europe are increasingly local citizens, rather than non-EU nationals, such as those who carried out the London bombings in 2005' (ibid). The potential adverse effects for Muslim citizens in the EU of new counter-terrorism measures are not known.

EU counter-terrorism policy has external portions as well that can be summarised in three core aspects: promoting UN conventions; dialogues on countering terrorism; and counter-terrorism assistance (Keohane, 2008). The EU continues to pressure the UN governments to adopt a common definition of terrorism. The EU has initiated counter-terrorism dialogues with several countries and regional organisations. For example, high-level political dialogues on counter-terrorism were initiated over the period 2004-2006 between the EU and US, Russia, India, Pakistan, Australia and Japan (ibid). Additionally, the EU offers counter-terrorism assistance through a variety of mechanisms including anti-terrorism clauses in agreements with other countries, counter-terrorism aid packages, and counter-terrorism training for soldiers and police from non-EU countries.

A summary of roles and responsibilities of government actors detailed from EU counter-terrorism policy is provided below. For preparedness at the community level there are many evident overlaps, for instance, local level authorities and institutions working should work in to ensure co-operation and interoperability with state actors for operationalising the actions outlined below at the local level.

Finance ministries

- Tracking funding for terrorist actions

Health ministries

- Stockpiling vaccines

Environment ministries

- Maintaining civil infrastructure

Additional changes for EU governments

- Actions for European police co-operation
- Anti-money laundering and asset-freezing laws
- Transport and border security arrangements
- Additional measures to help Member States' protect vital services such as health, food and water supply in the event of a terrorist attack
- Foreign policy measures, such as strengthening EU co-operation with UN and US

The second section focuses on a more specific terrorism threat example, chemical, biological and radiological (CBR) threats. The impact of a CBR event can vary based on factors such as type and amount of agent used, dispersion method, meteorological conditions and societal reactions (Lindstrom, 2004). At the EU level, the Community Mechanism was established in 2001 to reinforce cooperation in civil protection assistance interventions. Effective since 2002, the Community Mechanism is tasked with: identifying intervention teams and other support available in member states in the event of an emergency, establishing assessment and/or coordination teams, including dispatching teams when needed, setting-up and implementing a training programme for intervention teams and other coordination teams, establishing and managing a monitoring and information centre, and establishing and managing common emergency communication and information systems.

A second key action toward reducing CBR threats was the establishment of the Health Security Programme (BICHAT), which is the programme of cooperation on preparedness and response to biological and chemical agent attacks. BICHAT has four primary tasks pertaining to information exchange, detection and identification, medicine stocks, and providing coordination advice between member states.

Finally, a third important measure was the establishment of the programme to improve cooperation in the EU for preventing and limiting the consequences of CBR or nuclear attacks, the CBRN programme. CBRN's mandate is to 'improve cooperation between member States on the evaluation of risks, alerts and intervention, the storage of such means, and in the field of research' (Lindstrom, 2004, p 45). CBRN has seven objectives spanning conducting risk assessments (this has been done for

9 regions and 55 countries), reducing vulnerability (this has been addressed, for example, by reducing vulnerability in the food supply chain and aviation), detection and identification of attacks (main communication and information systems in the EU for this purpose have been improved under CBRN), mitigation of consequences of attacks (a database of military assets and capabilities that could be used in the event of a CBRN attack has been established), to strengthen scientific basis of the programme (addressed through research funding), to cooperate with third countries and international organisations (addressed primarily through the Global Health Security Action Initiative), and finally, to ensure efficient use and coordination of the instruments used in implementing the programme. In terms of practise, a CBR training exercise at the EU level called EUROTAX was held in 2002 in France. The exercise simulated a terrorist group detonating a radiological device in a sports stadium and cinema. Teams from five other EU countries took part in the exercise. The following section focuses on key challenges that have emerged for the CBR programme that limit preparedness (Lindstrom, 2004, pp 50-54).

Challenges to the Community Mechanism

- Member states are not obligated to inform the Monitoring and Information Centre (MIC) of an event, even if it has transboundary effects. This can reduce duplication, e.g. if an affected country seeks help bilaterally and then also from the MIC, efforts are duplicated.
- The MIC coordinates voluntary assistance and it is the responsibility of the member states to produce the necessary assets to respond to an emergency situation, which does not always happen. During the Portugal forest fires of 2003 21 countries initially signalled political willingness to help, however, only two countries (Italy and Germany) provided assistance.
- The MIC is limited by the small size of the Civil Protection Unit (CPU) that staffs it, as current numbers are around 20 (as of June 2004).
- Information can also be a challenge. For example, the demand for high capacity pumps, e.g. that can displace roughly 1.9 million m^3 per day, during the 2003 floods in France was high and could not be met easily because the database utilised did not provide information on equipment capacity and compatibility. This limited the response to 4 out of 7 countries who initially committed to helping.

BICHATs limitations

- Communications are challenging because the communication system is a passive mechanism, e.g. its relevance depends on voluntary usage—if it is not used during a crisis, it is largely irrelevant.
- Medicine stocks are also an obstacle and the following challenges have emerged:
    - An EU vaccination stock has been rejected by member states, as it has been argued there is no added value for the current set-up of national stockpiles.
    - Member states have voiced concern over the timely availability of vaccinations should such a (stockpile) system be introduced.
    - Member states prefer to keep vaccination information private from the public for security reasons.

Training exercise limitations

- Full-scale training exercises for testing capabilities during emergency situations have yielded several 'lessons learnt', e.g.
    - Incapability of equipment experienced across boundaries (e.g. exercises between France and Italy found fire hose equipment was not compatible)
    - Communication was a challenge when jargon and acronyms were used, teams could not understand each other. The use of walkie-talkies for communication also presented challenges.

Military limitations

- Policy guidelines should be specific as to the types of missions the military will be asked to assist with, for example, if they are to assist with decontamination, so that they can adequately prepare.
- Synergies with NATO should be explored.

Overall, it is evident that organisation, communication and interoperability have emerged as practical challenges for terrorism planning for local and transboundary events, and co-operation and legislation concerns still remain at the EU level.

Many of the challenges identified for CBR show similarities to emergency planning for natural hazards, for instance, having adequate and tested information systems, vulnerability and risk assessments, ensuring interoperability between teams and for equipment, enacting training exercises routinely, and ensuring adequate emergency supplies. As was discussed in Chapters 1-2, the natural hazards literature provides greater detail with regards to risk perception and factors such as willingness to work for emergency personnel and behaviour such as complying with evacuation orders that can be applied to terrorism preparedness. In contrast to natural hazards, issues of security and sovereignty are more of a concern for CBR and other terrorist hazard threats.

7. Literature review conclusions

Flood risk perception studies have increased significantly over the last decade, especially for the European context (see Wachinger and Renn, 2010; Wachinger et al., 2013; Kellens, Terpstra and De Maeyer, 2013). Risk perception, trust, responsibility, emotion and risk area (e.g. actual risk) were identified as important factors influencing preparedness intentions or actions. Demographic variables such as gender, age, experience, education, and socioeconomic status showed 'mixed' results for impacting preparedness, e.g. some studies found statistical relationships between risk perception and demographic variables and others did not. A key benefit of the risk perception approach, which commonly employs realist/positivist methods toward quantifying risk, is generating a baseline for risk perception and awareness. Additionally, many approaches combine quantitative/qualitative aspects, which help to better clarify context.

Studies reviewed here recommend that risk perception, though a factor in preparedness for earthquakes is also strongly influenced by other factors including social and normative factors. Paton et al. (2003) describe potential pathways between risk perception and preparedness in which risk

perception serves as a motivator or precursor to preparedness intentions. Intention formation is further influenced by factors such as outcome expectancy, self-efficacy, coping and response efficacy, which essentially describe an individual's perceptions regarding preparedness actions and their personal psychological resources that enable them to complete these actions. Finally, perceived responsibility, sense of community, normative factors including trust and empowerment, and other factors pertaining to the hazard event such as timing and response efficacy of relevant actors, influence an individual's preparedness actions.

Benefits of social-psychological approaches, many of which are constructivist in nature, are in enabling our understanding of the manner in which social and cultural factors and processes may influence risk perception and behaviour. Additionally, in identifying obstacles individuals may face for mobilizing or accessing personal psychological resources. A limitation of these approaches is that it more studies are needed, especially longitudinal studies, to draw conclusions about what aspects can be 'generalized' for preparedness applications and to what levels of society these results apply, e.g. individual, community, etc. Additionally, a limitation of constructivist approaches is that some do not consider the cause or constraints influencing preparedness actions, thus a critical element is needed for prevention/mitigation. The Paton et al. (2003) example, however, does consider this type of resource constraint, for example, through the 'empowerment' factors in the preparedness action phase.

Gendered analysis of the current literature highlights negative impacts pertaining to gender stereotypes and exclusion of females from formal emergency planning organizations on preparedness, emphasizing the need to collect sex disaggregated data and perform gendered analysis of this data to improve current preparedness initiatives. A study by Jonkman and Kelman (2005), for instance, highlighted males died more frequently during floods due to unnecessary risk-taking behaviour in case studies of flood deaths in Europe and the US. Similar results were found in an Australian study (see Heckenberg and Johnston, 2012). Other studies have found that women are more likely to hear evacuation warnings because of their greater involvement in social networks (Turner et al. 1979, 1981), to take warnings seriously (Drabek, 1969; Turner et al., 1981), to perceive natural hazards as more risky or serious (Szalay et al., 1986; Leik et al., 1982; Turner et al., 1986; Palm, 1995) and to evacuate (Drabek, 1969), unless they were at home with children or other family members (Drabek, 1969; Millican 1993). Gender stereotypes were also found to limit preparedness in some studies, for example, Enarson and Fordham (2000), in a joint UK, US case study illustrate examples where women's higher risk perception and intentions to take preparedness actions are dismissed as being stereotypical female 'panic' responses.

A key benefit of a gendered analysis is that it adds a critical analysis component. Gender is ascribed and socially constructed. Gender determines the roles, power, and resources for females and males in any culture (IASC, 2007). A key limitation regarding gender and preparedness is that only a small minority of risk perception studies currently incorporates a gendered analysis.

Review of risk perception and behaviour for epidemics/pandemics highlighted knowledge, trust and experience as key factors influencing the adoption of biosecurity measures, and age, gender, ethnicity/race and education as factors influencing preparedness behaviour for human diseases. Being female, a member of a minority ethnic group, and being older were positively associated with

protective measures (e.g. preparedness). Non-white respondents and lower income respondents more commonly practiced avoidance behaviour, however, no explanation is offered for this preference. These studies were largely realist/positivist approach.

Review of risk perception, behaviour and preparedness for terrorism revealed the intrinsic challenges for this hazard type, as there is no consensus on a definition for terrorism, or what causes terrorism. Some scholars have argued that terrorism is both socially and politically constructed (see Butko, 2009; Hüssle and Spencer, 2008). Studies reviewed here recommend respondents do not engage in mass panic behaviour (Alexander, 2003; Grimm et al., 2014), contrary to earlier studies on the topic, individuals/households typically do not prepare solely because of terrorism (Bourque et al., 2012), however, some have become more vigilant (Kano et al., 2011), and that risk perception plays a significant role for emergency and medical responders' willingness to work during a crisis (Smith, 2012).

Constructivist and critical studies recommend that communication and fear could play important roles in influencing behaviour and response to terror events. Racial profiling and hate crimes have occurred in some areas after terrorist events targeting individuals who share similar physical traits or political beliefs (see Peek and Sutton, 2003). This could be linked to media portrayal of terrorism, for instance, the use of hateful or blaming language, however more studies are needed to investigate this potential cascading effect. Some studies have recommended that fear can influence a person's perception of a threat, for instance, their comprehension of the threat and the significance they attach to the threat (see Durodié, 2007). Other studies, more realist/positivist in design, have found that women and ethnic minority groups report higher fear of terrorist attacks compared to men (Nellis, 2009), and similarly, respondents with lower income and educational level reported higher fear levels regarding potential terrorist attacks (Page et al., 2008; Boscarino et al., 2003). Other studies have recommended that, because of the diverse proclivities of different communities, risk communication for terrorism should not be viewed as a 'one- size-fits-all' approach (Kearon et al., 2007). Taken together, these findings recommend that a singular approach to communicating terrorism risk would be ineffective.

In conclusion, the peer-reviewed literature on risk perception and preparedness for the hazards examined highlights that considering realist, constructivist and critical approaches to risk perception can better inform how individuals and communities understand risk, as well as identifying the most effective measures for risk communication in accordance with social factors and norms, and finally, assessing when intervention at the social or political level is required to reduce disaster risk.

Additional illustrative review of technical and peer-reviewed articles examined legal roles and responsibilities, highlighting diversity in hazard governance across hazard types and member states in the EU. This report has highlighted a shift in conceptualisation of preparedness from a more risk factor or risk assessment centred approach, to a broader risk environment or risk management approach that considers social and environmental sources of risks for floods, earthquakes, epidemics/pandemics and terrorism between the 1930s and 1990s. In general, a shift toward decentralisation of hazard risk management and greater emphasis on participatory engagement with stakeholders has emerged for many member states across the EU and in other countries (see Walker et al., 2010). Similar trends of increased diversity in the number and type of stakeholders involved in

preparedness activities emerged across hazard types. Private landowners and developers have more clearly outlined responsibilities for natural hazards pertaining to hazard risk reduction and hazard risk management for some member states in the EU, however this varies with governance styles. Additionally, individual citizens have greater responsibility for preparedness and mitigation activities in many member states (see example of Johnston and Priest, 2008), but again, this varies with governance style. Some countries expect citizens to take preparedness measures whereas others do not. Fragmentation of institutions and organizations at the local level, challenges with interoperability of information systems and equipment, limited cross-border training, lack of resources and the need for improved social and vulnerability planning emerged as common challenges to preparedness for different stakeholders across hazard types.

8. Preparedness typology

The preparedness typology generalises key findings from the current report, engaging questions pertaining to the *i*) commonalities and differences of different sources of disaster risk, *ii*) the legal roles and responsibilities of different stakeholders engaged in preparedness actions, and *iii*) potential advantages and limitations of a multi-hazard, versus single-hazard, preparedness approach.

8.1 Commonalities and differences of different sources of disaster risk

General sources of disaster risk that emerged from the report are summarised in Table 13 (below). Scientific predication capabilities, e.g. predictability, and early warning capabilities vary for the different hazard types. While the types of floods that occur are quite diverse, (e.g. slower onset riverine floods, faster onset flash floods, groundwater flooding, etc.), monitoring and early warning capabilities are the most scientifically advanced for floods compared to other hazards. The science and technology is adequate to provide ample warning for most flooding events. Scientific monitoring of seismic activity is advanced, however, earthquake prediction is not available and only seconds of warning time is currently achievable for early warning systems. Predication capabilities are not available for epidemics/pandemics or for terrorism. Prediction and early warning capabilities have important implications for preparedness, primarily in terms of avoiding fatalities and personal losses. The more advanced the monitoring and warning capabilities, the better chance of providing adequate warning time. However, having advanced prediction and warning capabilities does not guarantee successful preparedness.

The physical environment may also influence preparedness differently for different hazard types. Civil infrastructure and transportation, for instance, have frequently been targeted for terrorist attacks. Building collapse is the most common cause of fatalities in earthquakes; thus, earthquake resilient building materials are a top priority for preparedness. Upstream mitigation measures for flooding can have negative impacts downstream, e.g. by directing more floodwater downstream, thus cascading effects are more of a concern for flood mitigation. Stockpiles of vaccines and biosecurity are greater concerns for epidemic/pandemic preparedness.

Personal, social, cultural and environmental factors or processes have also been shown to influence hazard preparedness with both differences and commonalities across hazard types and levels of stakeholder interaction. At the individual or personal level, self-efficacy, risk perception, knowledge

and information regarding the effectiveness of preparedness measures, emotions, and trust emerge as common factors influencing preparedness intentions and behaviours for floods and earthquakes. Risk perception shows greater variability for floods than other hazard types. Female gender, older age and belonging to a non-white ethnic group emerged as common factors positively influencing health preparedness. Social and cultural factors or processes such as social norms, (cognitive) biases, normative factors, and collective efficacy emerged as important factors influencing earthquake preparedness from an individual to a societal level. Trust emerged as a common factor influencing preparedness across hazard types. Greater adverse mental health impacts have been found for terrorism and mass shooting events compared to other hazard types. At the institutional or organisational level, across hazard types, fragmentation and interoperability were reported to be key obstacles for preparedness at the local to regional level. Some stakeholders such as certain land-use owners, for instance, the National Trust in the UK, or building developers, have greater responsibility for preparedness actions for natural hazards as hazard risk management has been decentralised under many governments. In contrast, for epidemics/pandemics and terrorism, some countries have taken a more centralised approach, as concerns over security and sovereignty emerge for terrorism and new public health initiatives, for instance in the UK, have recommended government intervention through health impact assessments or other mechanisms, to ensure public policy does not adversely impact health.

In terms of reported preparedness behaviours, for both floods and earthquakes non-structural preparedness measures such as stockpiling foods and supplies or purchasing insurance are more commonly reported (Table 13). This is important for preparedness because these preparedness actions have the most relevance for the post-impact phase and have little advantage in terms of mitigation or prevention for property loss or damage. For epidemics/pandemics it is possible to limit one's exposure through behaviour, e.g. avoiding crowds, public transportation, or mass gatherings and also through protective behaviours such as hand washing, wearing a facemask or respirator. For terrorism some preparedness research has found that respondents became more vigilant as a result of terror events.

Table 13: Some key commonalities and differences of different sources of disaster risk across hazard types examined.

Risk differences	Floods	Earthquakes	Epidemics, Pandemics	Terrorism
Predictability and early warning	High for most types of floods with adequate to ample warning times in most countries; information systems	Prediction not currently possible, very limited, e.g. seconds, of warning time; information systems	Prediction not currently possible; intervention strategies can limit the spread of infectious diseases; information systems	Prediction not currently possible; information systems
Physical environment	Land-use; habitat degradation; downstream impacts; public mitigation measures	Earthquake resilient infrastructure; public mitigation measures	Vaccine stockpiles; surge capacity; human resources	Civil infrastructure and public transportation frequently targeted; security/sovereignty concerns at national and international level
Social	Knowledge of private precautionary measures & effectiveness of measures; emotions; attitudes	Fatalism; biases; normative factors; collective efficacy	Quality of and access to health and social care	Root cause of terrorism unknown

Table 13 (continued): Some key commonalities and differences of different sources of disaster risk across hazard types examined.

Risk differences	Floods	Earthquakes	Epidemics, Pandemics	Terrorism
Individual	Risk perception; prior experience; homeownership; insurance; trust; knowledge of cause of flooding; resources	Educational level; age; gender; ethnicity; self-efficacy; emotions; trust; resources	Age; gender; ethnicity; behaviour (e.g. avoidant, preventive behaviour); trust; disease severity and likelihood; resources	Greater mental health impacts reported for terrorism and mass shooting events; media and communications; resources
Behavioural	Largely non-structural measures reported	Largely non-structural measures reported	Avoidance and preventive behaviour vary with demographic attributes (gender, age, ethnic group)	Increased vigilance reported in some studies
Political	Land-use and development; governance; social inequalities; resources	Land-use and development; governance; social inequalities; resources	Land-use and development; governance; social inequalities; resources	Land-use and development; governance; social inequalities; resources

8.2 Roles, responsibilities and preparedness

This report has highlighted a shift in conceptualisation of preparedness from a more risk factor or risk assessment centred approach, to a broader risk environment or risk management approach that considers social and environmental sources of risks for floods, earthquakes, epidemics/pandemics and terrorism between the 1930s and 1990s. In general, a shift toward decentralisation of hazard risk management and greater emphasis on participatory engagement with stakeholders has emerged for many member states across the EU and in other countries. Similar trends of increased diversity in the number and type of stakeholders involved in preparedness activities emerged across hazard types. Private landowners and developers have more clearly outlined responsibilities for natural hazards pertaining to hazard risk reduction and hazard risk management for some member states in the EU, however this varies with governance styles. Additionally, individual citizens have greater responsibility for preparedness and mitigation activities in many member states, but again, this varies with governance style. Some countries expect citizens to take preparedness measures whereas others do not.

Many of the obstacles to preparedness emerging from the literature review, for instance, fragmentation of institutions and organisations at the local to regional level, which can impede participation and interoperability, insurance related conflicts, e.g. lacking incentive for individuals or businesses to engage in preparedness activities when loss is covered by insurance, and lack of clear distribution and understanding of roles and responsibilities between various actors, which can further decrease preparedness, have been addressed through risk governance and risk resilience frameworks. Classifications by Walker et al. (2010) and Balamir (2002) provide useful methods for characterising risk governance and risk resilience, respectively. These types of analyses are lacking on the EU wide scale; however, they are available for some member states. These analyses would be useful, for example, for gauging the effectiveness of legislative changes, which is largely lacking at the EU-wide scale. As a next step, utilising results from the current report, it would be informative to supplement these risk governance/risk resilience frameworks with more detailed findings on the individual and community scale to assist local stakeholders and community members.

8.3 Advantages and limitations of a multi-hazard preparedness approach

Taking a multi-hazard approach to preparedness could have many advantages, as the process of doing so requires consideration and planning for a broad range of social, cultural, environmental and practical processes that are essential to sustainability and disaster risk reduction more generally. A multi-hazard approach can inform measures to prevent or mitigate cascading effects in some circumstances. For example, switching from brick masonry to wood based housing can reduce earthquake risk, but it also enhances fire risk. A multi-hazard approach considering earthquakes and fires, therefore, could better inform preparedness for potential cascading or secondary effects from fires. A multi-hazard approach would require greater consideration for the interoperability of information systems and communication between various stakeholders, which could also be advantageous for preparedness. For example, information systems may be tested and used more frequently in a multi-hazard scenario. Furthermore, a multi-hazard approach could better inform resource allocation across different levels; mental health resources may be a more immediate need

after a terrorist event, whereas social isolation may emerge as a pressing concern for mental health after a longer quarantine event for an epidemic/pandemic.

Potential drawbacks to a multi-hazard approach are also evident. For instance, there is a risk of over generalisation and loss of specific knowledge and handling for certain hazard events. It may be optimistic to expect risk managers and practitioners to have specific knowledge on multiple hazards, thus it would be essential to maintain a balance of hazard specific and more general risk management practitioners. Governance and finances would be similar concerns; an effective multi-hazard approach would need to ensure balanced and fair financing and management for different hazard events.

8.4 Report conclusions and summary tables

To conclude, this report reflects an iterative process of literature reviews and discussion with experts on risk perception and preparedness concerns for a multi-hazard, multi-stakeholder context. Building from prior work on risk perception and preparedness in the European context, and through consultation with experts in the field of disasters and disaster risk management, key components of preparedness were identified as 'knowledge/information', 'motivation', 'networks', 'responsibilities' and 'resources' to guide the development of a preparedness typology. An academic literature review on risk perception and preparedness considering floods, earthquakes, epidemics, pandemics, and terrorism as case studies was then conducted to further augment the definition of preparedness and the refine the preparedness typology. Results of a literature review of preparedness in theory and practice recommend that a definition of preparedness should be flexible enough to encompass multiple time and space scales, different levels of organization, as well as social and environmental capacities. For these reasons, in addition to the wide international recognition of the United Nation's Office for Disaster Risk Reduction (UNISDR), UNISDR's definition of preparedness was adopted by the consortium for use in the TACTIC project:

> "The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions." (UNISDR, 2007)

Results of a literature review on risk perception and preparedness were used to draw out similarities and differences between different hazard types, considering different stakeholder perspectives, to add further detail to the preparedness typology. Tables 14-16 (below) synthesize key findings from the literature review augmenting the preparedness typology. These summaries are not meant to recommend that findings from one hazard are exclusive to that hazard type or exhaustive, rather, they reflect key points that emerge from the risk perception and preparedness literature for each hazard type that may be important considerations for a multi-hazard preparedness approach.

Review of the natural hazards literature on risk perception and preparedness, especially the flood studies reviewed here, highlights gaps in perceptions of roles and responsibilities between private citizens and government. While many governments have undergone a process of decentralization with regards to hazard risk, risk perception studies recommend that citizens are often unaware of

their legal roles and responsibilities for hazard preparedness. In addition, both flood and earthquake risk perception studies reviewed here recommend that information on the effectiveness, reliability, and cost of private precautionary measures is often lacking and may impede preparedness. There is a gap in knowledge pertaining to multi-hazard, multi-stakeholder preparedness planning at the community and organization level, as most studies focus on individuals or homeowners. Factors such as emotions and trust, knowledge of the cause of the hazard, and 'actual' risk also emerged as important factors influencing risk perception and preparedness for floods.

Social-psychological studies of risk perception and preparedness for natural hazards have provided insight regarding the influence of personal, or psychological, resources on preparedness motivations and behaviour. Factors such as self-efficacy, self-esteem, or personal attitudes and beliefs can influence a person's intentions and preparedness actions. Optimism, fatalism, normalization bias, or other beliefs may can all negatively impact preparedness motivations and behaviour. The actions of a person's social reference group can further impact preparedness motivations and actions; individuals are more likely to adopt preparedness measures if they observe others in their social reference group doing the same. A key knowledge gap identified pertains to understanding how motivations may vary for groups of people or communities, as studies most frequently examine individual motivations.

Some constructivist and critical research approaches have recommended that collective attitudes and beliefs influence motivations and actions relevant to preparedness for individuals and communities. Overly optimistic and fatalistic attitudes may be prevalent from an individual to societal scale and act to decrease preparedness. Learned gender bias has also been shown to negatively impact preparedness in numerous circumstances by casting many preparedness activities traditionally undertaken by women as unimportant, unnecessary, or 'feminine' and often encouraging risky behaviour by men. A key gap identified here is in understanding how learned attitudes and behaviour influence preparedness, as more longitudinal studies are needed to draw these conclusions.

Terrorism and epidemics/pandemics are less commonly considered hazards in the risk perception and preparedness literature. Communication emerges as an important theme for terrorism preparedness, as studies reviewed here recommend that emotions such as fear may influence a person's perceptions of terrorism. Demographic variables such as age, gender and ethnicity have also been found in some studies to influence people's perceptions of terrorism risk. Thus, the key message here is that risk communication for terrorism must take into account different worldviews or perspectives in order to be effective. For natural hazards and epidemics/pandemics, communication concerns in risk perception studies commonly centre on early warning or risk communication. Terrorism studies reviewed here recommend that communication itself can serve as a vehicle to enhance or deter terrorism preparedness; the manner in which citizens and the media communicate regarding terrorist acts can influence people's perceptions and ultimately, the impact of terrorist actions, in both positive and negative ways. Unlike natural hazards and epidemics/pandemics, the definition and cause of terrorism are widely debated, which complicates preparedness and further emphasizes the need for clarity in communication. Additionally, available psychological and social-psychological studies on risk perception and terrorism recommend more adverse psychological impacts for terrorism events compared to natural and technological hazards. This may recommend the need to consider psychological preparedness as an element of terrorism preparedness.

Risk perception and preparedness studies for epidemics/pandemics for human health tend to focus on individual protective activities such as hand washing, wearing a mask or respirator, avoiding crowds or public transportation and less on community level intervention strategies. While some community level intervention strategies such as school closures are evident in the literature these examples are limited. Thus, a gap in knowledge is evident pertaining to community level intervention strategies for epidemics/pandemics preparedness. Risk perception and preparedness studies for animal epidemics/pandemics reviewed here tend to focus on motivations or factors influencing the adoption of biosecurity behaviour.

Similar to natural hazards, trust and information regarding biosecurity measures emerged as important factors influencing preparedness motivations and actions in several studies reviewed here. Veterinarians were commonly viewed as a more trusted source of information on biosecurity in comparison to local or national authorities. Membership in social networks such as cattle health schemes or organic farming was found to positively impact biosecurity preparedness in some studies, which recommends greater attention to the role of networks in biosecurity preparedness in future research could be advantageous.

Table 14: Summary for 'knowledge/information' and preparedness findings

Knowledge & information			
Floods	**Earthquakes**	**Epidemics/Pandemics**	**Terrorism**
Key findings • Actual risk area is correlated to risk perception in some studies. • Information on cause of the hazard was found in some studies to benefit risk perception and preparedness. • Lack of knowledge of private precautionary measures and benefits, and of legal responsibilities for preparedness/mitigation measures was evident in many EU case studies. Changing roles for certain landowners and businesses identified at the local scale. • Many studies consider 'prior experience' with flooding a factor influencing risk perception and results are 'mixed' as a variety of intervening variables have been recommended such as personal losses incurred during the experience, or time since the event. • Some studies recommend that people's knowledge/information regarding different types of flood hazards varies broadly, e.g. more knowledge or river floods versus groundwater floods • Overall, risk perception of floods varied quite broadly within the EU context	**Key findings** • Risk communication is more effective in prompting earthquake preparedness if it communities explicit information on the risk and is consistent with social norms. • Several studies found prior experience did not necessarily increase earthquake preparedness. • Some studies have recommended legislative action is needed to enforce building codes and earthquake resilient development.	**Key findings** • Lack of information regarding protective measures emerged as a challenge to biosecurity for animal diseases • Some studies recommended higher biosecurity preparedness in less rural farms; however, longitudinal studies are needed to identify trends • Intervention strategies for infectious diseases such as school closures, travel restrictions; personal measures (use of face masks/respirators) are clearly outlined at the national and EU level. This is an area that could inform natural hazards planning and one that could also be improved by detailing interventions at the community level • Veterinarians were frequently viewed as the most trusted sources of biosecurity information.	**Key findings** • Specific language and discourse surrounding terrorist events plays a central role in communication • Lack of consensus on the definition of terrorism has precipitated challenges for preparedness. • Some studies reported that respondents increased their knowledge of terrorism through information seeking as a preparedness measure. • Some studies recommend that demographic variables influence a persons' fear of terrorism. Thus, a single approach to prepare the public for terrorism may be inappropriate.

Key results for communication and education: 'Knowledge/information'

The role of knowledge and information on risk perception and preparedness actions varies across and within hazard types examined in this report as well as across Europe (Table 14 above). This has implications for attempts at improving knowledge through communication and education. General implications are as follows:

- Information about roles and responsibilities for managing the given hazard at every stage of the disaster cycle as well as the cause of the hazard should be clearly communicated.
- Specific actions to be taken by the audience in order to increase preparedness could benefit from being developed together with the audience.
- Multiple approaches to communication and education are likely to be more effective than a single method as different audiences require different methods of communication.

Studies reviewed here also recommend that careful attention should be paid to factors or variables such as prior experience, perceptions of preparedness measures and responsibilities for such measures, and details regarding the content and structure of communications, e.g.:

- Flood studies especially reflected the need to consider prior hazard experience (e.g. whether or not the individual/community has experienced a hazard in the past and incurred losses/damages during hazard events) for risk communication. This may be equally valid for other hazard types.
- Many natural hazard studies found that perceptions of responsibility for the management of hazard events varied quite broadly. Communication activities should to take into account how the audience perceives responsibility for the management of hazards (e.g. role of public technical protection measures, the state, insurance and other personal measures).
- Several studies across hazard types recommended that knowledge/information regarding the cause of the hazard should be conveyed when possible for risk communication. For natural hazards, some studies found that knowledge of the cause of flooding was correlated with higher risk perception or awareness. Some earthquake studies have found that communicating accurate information regarding potential damage is more effective for risk communication. This likely applies to other hazard types as well.
- Similarly, knowledge/information regarding protective measures or preparedness activities, as well as the efficiency and/or benefit of such activities, was recommended in several studies across hazard types to influence preparedness intentions or actions.
- Many studies recommend that knowledge/information regarding social norms is needed for effective risk communication. Thus, communication efforts should seek to understand relevant social norms and convey risk information appropriately.
- Trust in authorities local authorities, veterinarians, or other relevant actors emerged as an important factor influencing perceptions of preparedness and preparedness measures and should be considered as an element of effective risk communication.
- Terrorism studies emerging from the political and social sciences reviewed here recommend that the use of language and metaphors in terrorism communication can have a significant impact on event outcomes. Thus, language and communication style need to be considered for effective risk communication. Similarly, emotions such as fear and demographic variables such as gender and ethnicity were shown to influence people's perceptions of terrorism in some studies, recommending that multiple worldviews or perceptions need to be considered for effective risk communication.

Table 15: Summary for 'motivation' and preparedness findings

Motivation			
Floods	Earthquakes	Epidemics/Pandemics	Terrorism
Key findings	**Key findings**	**Key findings**	**Key findings**
• Many studies in the EU context have found that risk perception is highly variable. • Trust in local authorities, positive identification with place, observing others adopting preparedness actions and problem-based coping have been found in some studies to positively impact preparedness • **Some studies found that risk area or 'actual (physical) risk' was correlated to risk perception, e.g. people living in the floodplain or in low-lying regions had a better understanding of their flood risk. However, this knowledge did not always lead to preparedness actions.** • Societies favoring collective action tend to prefer government intervention for mitigation/preparedness. • Studies in the EU have shown citizens often prefer publicly funded mitigation measures and may not recognize their legal obligations related to preparedness.	• A key message from earthquake risk perception studies is that risk perception does not directly lead to preparedness actions, rather, it is one factor among others influencing behaviour. • Studies have found risk perception was related to certain types of preparedness measures (e.g. mainly relevant for the post-impact phase) but was not a strong predictor of preparedness on its own. However, some studies have found it is a motivator or precursor to preparedness intentions. • Personal resources, such as self-efficacy and coping influence preparedness intention formation. Social norms, responsibility, and factors such as trust have been found to influence preparedness actions. • Societies with higher collective efficacy tend to expect more preparedness intervention/support from the government. • Some studies have shown attitudes and beliefs, such as fatalism and optimism, negatively impact preparedness across different levels of	• Older age, being female, and being from a non-white ethnic background are factors that have been found to positively impact epidemic/pandemic preparedness • Personal resources such as self-efficacy and emotion also emerge as factors influencing biosecurity behaviour and health preparedness • Several studies found that higher perceived severity of a disease, perceived susceptibility/likelihood, and benefit (efficacy) of protective measures positively influenced preparedness behaviour. • Trust emerges as an important factor for both animal/human diseases influencing preparedness. Local authorities are generally found to be trustworthy, which can positively impact preparedness and preparedness-recovery. • Willingness to work during an epidemic/pandemic is a concern for medical personnel.	• The use of specific discourse and metaphors should be an area of concern for risk communication with regards to terrorism, as there is the potential to impede understanding of the root cause of terrorism by adhering to a mainstream approach (e.g. assuming that terrorist acts are promoted purely by evil or malice may overshadow additional factors such as socio-economic and environmental conditions that might also be motivating factors). • Risk perception studies on terrorism recommend that people do not prepare solely for terrorism; rather preparedness is motivated by a variety of factors. Many people report becoming more vigilant as a result of greater awareness of terrorism. • National sovereignty is linked to security, which poses a challenge to EU wide security policy changes for terrorism. • There is a hesitance to share intelligence information widely for fear of leaks, which intersects with

• Many studies recommend greater time in residence and prior flood experience can positively impact preparedness. However, other factors such as demographic variables can intervene. • Many studies recommend that risk perception changes after a flood hazard event. This information could be applied to other hazards to identify ideal times for capacity building and targeting communication materials. • Many studies have found gender differences in the types of preparedness activities people engage in and the value these activities are assigned within different communities; this can present obstacles to preparedness. • Many studies have shown women tend to have higher risk perception, take hazard warnings more seriously and comply with evacuation warnings	society/organisation. • Several studies found females to have higher risk perception and elderly to have lower risk perception, which could influence motivation or intention to prepare. • Many studies have found home owners adopt more preparedness measures. • Several studies indicate that the behaviour of ones' social reference group are important factors influencing preparedness behaviour, e.g. observing others in your social group taking preparedness actions positively influences preparedness behaviour	Studies have shown that personal responsibilities (e.g. childcare/eldercare) can negatively impact willingness to work. • At the scale of the EU, there is a hesitance by Member States to stockpile vaccines, where the preference has been to do this on a state-by-state basis.	information and network concerns.

Key results for communication and education: 'Motivation'

Motivation to act is seen to be an important factor in influencing preparedness behaviour. Motivation is influenced by belief in self-efficacy, emotions, attitudes, perceived responsibility for hazard management, and social norms (Table 15 above). Motivation may also be influenced by demographic factors such as age, gender, and ethnicity. This finding is relevant as it points towards the importance of gaining an understanding of individual and social motivations when developing communication and education practices for improving community preparedness. General implications for motivation are as follows:

- The sources of motivation to act are likely to vary within a given society. Therefore, more than one method of communication is recommended. Other things to take into account are demographic factors and their impact on motivation, the impact of the potential hazard on different members of the community (e.g. health workers, citizens, etc.), as well as the timing of communication.

Other results linked to motivation with implications for hazard communication also emerged:

- The reasons that people are motivated to prepare for hazards varies therefore, communication practices should take into account different actors sources of motivation.
- Perceived responsibilities seem to have a strong impact on whether individuals take preparedness actions. Therefore, responsibilities and concrete actions should be clearly communicated (e.g. if residents believe that the responsibility for managing flooding is that of the state, they are unlikely to take preparedness actions). Similarly, if collective efficacy characterizes a society, citizens' are more likely to view preparedness as the government's responsibility and thus may be less motivated to engage in private precautionary measures.
- Communication regarding hazard preparedness should take into account, social norms, beliefs in self-efficacy, and trust in the communication source when trying to increase motivation to act.
- The timing of hazard communication should be taken into account.

Table 16: Summary for 'networks' and preparedness findings.

Networks			
Floods	**Earthquakes**	**Epidemics/Pandemics**	**Terrorism**
Key findings	Key findings	Key findings	Key findings
• Women are underrepresented in formal emergency planning agencies in many countries. • Networks did not emerge as a strong focus in flood risk perception studies. Indirectly, some studies implied the importance of social networks or community ties as imbuing better knowledge and information for hazard preparation. • Some studies found a positive relationship between social involvement in the local community and willingness to take preparedness actions.	• Studies have found that strong family and community networks, characterized by planning and good communication, are strong predictors for preparedness • Some studies have found disaster training alone may not increase preparedness. • Some studies have identified the fragmented nature of institutions/organisations at the local level as an obstacle for preparedness. This applies to other hazard types as well.	• Some biosecurity studies have found that membership in professional networks positively impacted biosecurity preparedness.	• Networks do not emerge in the risk perception literature on terrorism as a central theme. However, the disasters and hazards literature implies that networks may be of greater concern, as interoperability between actors may be a greater concern, for terrorism.

Key results for communication and education: 'Networks'

The discussion regarding the importance of networks varied across hazards (Table 16 above). Generally, strong networks are believed to help in sharing knowledge and information as well as pooling resources, increasing motivation to act and providing support in the event of a hazard.

Other factors or variables identified pertaining to networks from the report with further implications for hazard communication include:

- Several studies have shown that strong family and community networks, characterized by planning and good communication, are strong predictors for preparedness. Hazard communication that emphasizes capacity building for family and community networks may therefore improve preparedness. Other biosecurity studies have found that membership in professional networks may positively influence preparedness, which recommends that focusing communication efforts on engaging relevant groups and encouraging membership could further promote preparedness.

Key results for communication and education: 'Responsibilities'

Discussions regarding responsibility show that in order to improve community preparedness to hazards, a clear understanding of expectations and existing responsibilities related to the management of a given hazard is required (Table 17 below). If preparedness actions are required from the community, it is important to be clear about the types of actions that can be taken, at the same time as gaining an understanding of what the community perceives as its responsibility and what it perceives to be the responsibility of the state to be.

Additional implications from the report relevant to 'responsibilities' and communication include:

- Similar to implications noted for 'motivations', communication actions should take into account the legal and perceived responsibilities of different target audiences. Communicating legal responsibilities could support motivation to act. However, if the audience does not perceive the preparedness actions as their responsibility, communicating the responsibility without acknowledging the audience's expectations (e.g. that public protection measure and/or the state will protect them) are unlikely to be effective.
- Communication of the cause of hazards, especially for epidemics/pandemics (e.g. relaying information on the transmission of disease) can help to improve preparedness by helping people understand the role they can play in hazard impacts.

Table 17: Summary for 'responsibilities' and preparedness findings.

Responsibilities			
Floods	**Earthquakes**	**Epidemics/Pandemics**	**Terrorism**
Key findings	**Key findings**	**Key findings**	**Key findings**
• Many studies have shown households with children or dependents are more likely to take certain preparedness actions. • Several studies highlight disagreement regarding the trend toward privatisation of flood risk and the associated gain in risk responsibility at the individual/community level. • Some countries have shifted greater flood risk management responsibilities onto citizens with little to no legislative changes. • Some studies explored people's preferences for different types of flood defences finding a preference for public flood defences such as dikes or levees • Some studies explored citizen's knowledge of their legal responsibilities for private precautionary measures, finding many were unaware of their obligations.	• Perceived responsibility and sense of community have been found in some studies to influence the pathway from preparedness intentions to preparedness actions. Other hazard types may benefit from this research. • Many studies have shown households with children or dependents are more likely to take certain preparedness actions.	• Willingness to work of healthcare personnel during a pandemic/epidemic emerges as a key concern in the literature. Some studies recommend a need to consider employee's childcare/eldercare responsibilities as motivating factors regarding willingness to work during a pandemic/epidemic. • Biosecurity preparedness studies recommend differing opinions among stakeholders regarding responsibility for biosecurity related preparedness; some studies recommend veterinarians place greater onus on farmers to improve biosecurity whereas some farmers place greater emphasis on government responsibility.	• Some studies recommend a greater impact on personal (e.g. psychological) resources for survivors of terrorist events.

Key results for communication and education: 'Resources'

Resources discussed in the literature review include, financial, physical structures and services as well as psychological (e.g. ability to deal with stress) (Table 18 below). Gaining a clear understanding of the types of resources that exist in communities and the role that these resources play is an issue that needs to be further explored in the development of the audit. Demographic factors identified as having an influence on resources are social class, education level and access to resources.

Additional implications from the report relevant to inform communication regarding 'resources' include:

- The lack of capacity building evident for many hazard types recommends the need to clearly identify goals for capacity building. Flood research examined here, for example, points to the influence of social class and financial resources for preparedness. Demographic data, surveys, and indicators of vulnerability and exposure can be used to better understand capacity strengths and weaknesses across social and environmental dimensions.
- Business and livelihood continuity plans and strategies should be better incorporated into preparedness planning.
- For terrorism presents additional complexities for natural hazards in that the target audience for risk communication includes the individuals/groups perpetrating the terror act. Some studies have recommended lack of social resources and/or a response too corruption as inciting terrorist acts, thus implying that these vulnerabilities should be considered for risk communication.

Table 18: Summary for 'resources' and preparedness findings.

Resources			
Floods	**Earthquakes**	**Epidemics/Pandemics**	**Terrorism**
Key findings	**Key findings**	**Key findings**	**Key findings**
• Some studies recommend social class is a strong predictor of flood risk awareness. • Some studies have found that lack of resources and mistrust in authorities promotes non-adaptive behaviour.	• Housing recovery (e.g. planning for transitional and temporary housing) is an area requiring greater attention for preparedness planning. Some studies have shown the negative impacts of poor housing recovery planning on people (e.g. related to loss of livelihoods, isolation) and the environment (e.g. utilising green space or agricultural areas). • Higher educational level generally leads to higher risk perception, but this is sometimes mediated by higher socio-economic status, which sometimes decreases risk perception.	• Personal resources, social networks, other social factors and norms and environmental impacts were rarely examined in the studies reviewed here on risk perception. However, health promotion studies commonly examine the influence of these factors on health and wellbeing.	• Some studies have found the impact on personal or psychological resources due to terrorist events to be more severe or traumatic compared to other hazard types. This suggests a need to better consider psychological preparedness as an element for terrorism preparedness and to guide relief efforts after an event. • Resource limitations such as human and financial resources have been found to limit the ability to perform regular cross-border training exercises in the EU context. • Interoperability of resources and communication obstacles have arisen as challenges for terrorism preparedness in some EU case studies. • Physical infrastructure appears as a concern for many terrorism preparedness studies, though it is not evident what, if any, role the community plays in infrastructure related preparedness.

8.5 Research gaps and implications for TACTIC project

The main research gaps identified in this report and potential implications for the TACTIC project are highlighted in the bullet points below.

- Flood types vary broadly in their spatial and temporal characteristics and thus the associated risks posed. The majority of the studies reviewed here, as is the case for the majority of the risk perception and preparedness literature on floods, pertained to river floods. There is a need to evaluate risk perception and preparedness for a broader scope of flood types, especially for a multi-hazard context, which was noted in some studies. The same applies to other hazard types examined here; for the epidemics/pandemic and terrorism studies reviewed, uncertainty pertaining to the cause and timing of the hazard event, as well as the potential impacts, recommends that the scope of scenarios examined, e.g. from the type, timing, duration and exposure, require greater consideration. Scenarios are commonly incorporated as an element of preparedness planning. For all hazard types, utilization of scenarios as an element of hazard planning, but more importantly, in conducting field exercises or drills, may be an important preparedness element; not with the goal of accurately predicting the specific characteristics of hazard events, which is difficult to impossible for some hazards, rather, because the act of planning coupled with field exercises or drills can improve communication and interoperability between actors and identify weaknesses in current plans.

- Understanding motivation emerges as a key challenge for preparedness across hazard types, manifesting in similar and different ways for different hazard types and contexts. For natural hazards, some earthquake studies, for example, have illustrated complex relationships between disaster cognitions and behaviour from the individual to larger societal scale. For example, risk perception, critical awareness and emotions have been recommended in some studies as motivators or precursors to (preparedness) intention formation. Personal resources such as self-efficacy and coping have been recommended in many studies in the natural hazards literature to influence preparedness intentions. Additionally, results from many flood studies reviewed that show a lack of knowledge of private precautionary measures, including the cost, efficiency and responsibility for such measures, may further influence peoples' perceptions of preparedness and intentions to prepare. Attitudes, beliefs, and norms have been shown in many studies to influence linking preparedness intentions to actions. The literature reviewed here across hazard types also shows diversity in how these different factors are operationalised and potential for mediation and/or non-linear relationships between variables. While theories linking risk perception to preparedness behaviour have been established across different disciplines, there is an obvious need for further trans-disciplinary research to continue validating and refining these theories given the inherent complexities of hazard risk and diversity of people and hazard contexts.

- For all hazard types there was a general absence of discussion of business and livelihood continuity planning as an element of preparedness with a few exceptions. Adverse health and environmental impacts that emerge in the hazard and disasters literature, for example, temporary housing on green field sites that occurred after the L'Aquila earthquake in Italy, which led to challenges with transportation, livelihood continuity, isolation and other environmental impacts, or mental health implications arising from isolation during quarantine during the foot-and-mouth epidemic in the UK in 2001, as families and communities were isolated from each other and the tourism industry suffered major disruption in affected communities, recommends that the social and environmental dimensions of hazards require greater consideration in preparedness planning.

- Across hazard types examined here there was a gap in the preparedness literature pertaining to changes in vulnerability and exposure to hazard risk with some exceptions, which was noted as a challenge in many studies. Vulnerability remains a debated topic in the hazards/disasters literature, e.g. there is no agreed upon definition or method for monitoring vulnerability. However, much of the preparedness literature examined here discusses similar dimensions of vulnerability including physical (e.g. actual exposure, environmental conditions, etc.) and social (e.g. arising from both personal and collective decisions, etc.). For preparedness this recommends the need for a 'multi-directional' exchange of information and needs assessments; monitoring risk factors and vulnerability indicators should to be balanced with longer-term strategies for risk management focused on reducing disaster risk, which can reduce vulnerability.

- Frameworks have been established to enable mapping legal roles and responsibilities under changing risk governance landscapes; however there is a need to extend these studies for the EU wide context and also at the local or community level.

- Additional studies outlining social and cultural norms are needed in order to enable effective risk communication, as norms and beliefs have been shown in many across hazard types examined here to influence peoples' perceptions of risk. Similarly, many studies have shown that traditional gender roles and stereotypes can negatively impact preparedness and potentially promote risky behaviour. This recommends the need for preparedness planning to incorporate sex disaggregated data and gendered analysis for a variety of cultural and social contexts.

- Across hazard types there is a general lack of studies conducted at the community scale, or more practically, on larger groups of people, as most studies focus on individuals or households.

8.6 Linking to other TACTIC work packages

Common themes or subcategories to the preparedness components that emerged from this report (WP1) included:

- Social norms (e.g. attitudes, beliefs, biases)
- Cultural norms (e.g. collective beliefs)
- Personal resources and emotions (e.g. self-efficacy, trust)
- Social support resources (e.g. community based organisations, professional/employment resources, collectives, other networks)
- Responsibilities (e.g. personal such as childcare, elder care; willingness to work; legal roles and responsibilities)
- Knowledge/information (e.g. information on protective measures, including reliability, cost, efficiency and responsibility; knowledge gained from prior hazard experience; information systems, e.g. collection and dissemination on physical, social and environmental dimensions of hazard risk; language used for risk communication; manner of engaging with risk communication)

These categories or preparedness subcomponents may differ in their level of importance for each hazard situation, as individual and collective worldviews differ along with the actual hazard risk. The first three categories, e.g. social norms, cultural norms, personal resources and emotions can be used to further augment the 'motivation' preparedness component. Personal resources can also augment the 'resources' preparedness component. The 'social support resources' subcomponent can be used to augment the preparedness components 'networks' and 'resources'. The 'responsibility' and 'knowledge/information' preparedness components can be augmented by expanding the level of detail considered, e.g. for 'responsibilities', personal responsibilities such as childcare or eldercare, shown to influence willingness to work in crisis situations in some studies, should be considered a preparedness element. Information on the cost, efficacy, individual responsibility, prior hazard experience, and the dimensions of information systems (e.g. ensuring both social and physical hazard conditions are considered) can augment the 'knowledge/information' preparedness component. Additionally, the style and content of risk communication, including how citizens are encouraged to engage, can further augment the 'knowledge/information' preparedness component.

The second and third TACTIC work packages, WP2 and WP3, develop a participatory community level preparedness audit and establish a library of best-practices for preparedness for a multi-hazard, cross-border context. WP2 aims to collect existing vulnerability, capacity, and resilience assessments or audits in order to gain an overview of the types of audits or assessments that already exist and use these tools to help develop and inform TACTIC's participatory community preparedness audit. This will be achieved through conducting desktop research as well as expert interviews. WP1 results, which identified key components of preparedness, as well as potential obstacles to preparedness, will then be applied to further supplement audit questions developed in WP2. Thus, audit questions reflect the preparedness components (e.g. 'knowledge/information', 'motivation', 'responsibilities', 'networks', and 'resources') and subcomponents identified in WP1.

The objectives of WP3 are two-fold:

- It identifies and draws on existing good practices of communication and education for preparedness (with a particular focus on but not limited to large scale and cross border hazards which are low risk but high impact)
- It creates a library of good practices that will be used to help identify ways in which communities can develop preparedness based on their needs, strengths and weaknesses (identified through the audit) with a focus on large scale, cross-border crisis and low probability/high impact scenarios.

WP3 will be conducted in close collaboration with the participatory processes within the selected case studies (WP4-7) including practice partners (such as NGOs and disaster risk management organisations) and members from the public as well as experts and authorities involved in disaster risk management. WP1 links to WP3 both through discussions with experts and practitioners, which informed the structure of the literature review (e.g. identifying additional keywords and reference articles), as well as by influencing the development of audit questions for WP2. The specific hazard case studies in WP4-7 can use the literature review sections and results from WP1 as a foundation that is expanded and further refined with the expert knowledge of project partners leading the WPs and the audit results.

8.7 Future research applications

This WP1 report is unique in its consideration of a broad span of hazard types, as well the diverse ontological and epistemological research approaches to risk perception and preparedness reviewed. Results of this report can be applied to future research efforts to identify best suited, likely trans-disciplinary, approaches needed to address both objective elements of hazard risk and subjective social elements of risk. While researchers have recommended frameworks of this nature from various disciplines, further research is needed to test and validate these frameworks across a range of hazard types and contexts. Final results of the TACTIC project will significantly contribute to this effort.

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Introduction

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APPENDIX 1: Description of Work

Objectives

The overall objective of WP1 is to identify pathways from risk perception to preparedness. Therefore WP1 focuses on risk perception and behaviour and identifies factors that lead to a better understanding of whether risk perception affects individual preparedness actions. More specifically, this WP pursues this objective by:

- Developing a definition of preparedness which is agreed upon by the consortium
- Developing a preparedness typology. This will be achieved by identifying and understanding the perceived and legal roles, responsibilities of and types of action taken by different actors (e.g. individuals, organisations and responsible authorities) in relation to preparedness. This information will include a range of hazards, including large scale and cross-border hazards/disasters as well as take into account their cascading effects;
- Identifying factors (e.g. cultural and individual) that influence and define how individuals perceive and are aware of risks and, in addition, how these factors influence and define behavioural responses to, and responses for, risk and emergencies as well as the current level of individual/community preparedness within a given community; and
- Better understanding the impacts and effects of preparedness activities which can be taken by individuals, organisations and responsible authorities with regard to different crisis and disaster scenarios (including short- and long-term scenarios).

Task 1.1: Defining preparedness

Task leader: UoN

In order to develop a clear and agreed upon definition of what preparedness entails and to therefore strengthen the objectives of the project as a whole, it is important to conduct a review of how preparedness as a concept is used in theory and practice.

Task 1.2: Multi-hazard and multi-stakeholder preparedness typology

Task leader: UoN

This task will develop a preparedness typology with regard to different hazards, including cascading effects, in a multi-stakeholder context. The focus will be on different crisis and disaster scenarios arising from natural hazards as well as pandemics/epidemics, and terrorist attacks. It will focus on questions such as:

1. What are the commonalities and differences, synergies and trade-offs with regard to preparedness actions in relation to the different sources of risks and disasters?
2. How important is the hazard type to the outcome, relative to the underlying (social, political, etc.) context?
3. What are the legal roles, responsibilities required by which actors (individuals and responsible organisations and authorities)?
4. What are the advantages and possible limitations of a multi-hazard preparedness approach in contrast to a single hazard-focused approach? This task will be based primarily on a broad based literature review and conceptual reasoning.

Task 1.3: Identification of the state-of-the-art theories and knowledge on risk perception and its effects on behaviour as well as preparedness actions.

Task leader: UoN

This task will be completed in three steps. First, it begins with gaining and understanding of the types of hazards that attract different actors' attention and why, before further exploring which factors influence individual behavioural responses and preparedness. Therefore it focuses on the perception of risk arising from natural, technological and social hazards in order to better understand which hazards are likely to attract attention from governments as well as the types of hazards that receive public attention. More specifically, it will focus on questions such as:

1. What are the main factors that influence the way in which the public perceives the different risks outlined above?
2. Which hazards receive the largest amount of attention and why?
3. How are large scale/cross border disasters perceived in comparison to other types of hazards (e.g. frequent/small scale disasters)

In a second step, the relationship between risk perception, behaviour and preparedness is further explored:

1. Does high risk perception lead to action or improved preparedness?
2. What are the critical factors which lead to individual action and preparedness?

This task will draw upon previous studies in disaster risk but also look to other discourses such as health, social psychology and climate change as these areas have developed a significant body of work related to public engagement and behaviour change that can be drawn upon.

In a third step, the task will specify the influence of citizens' participation and involvement in communication and training initiatives on their perception, awareness and preparedness by highlighting potential deficiencies and opportunities which may have an influence on whether or not local actors take actions to protect themselves. This also includes a review of the literature focusing on the effects of communication/education on risk perception/behavioural changes.

Task 1.4: Roles, responsibilities and preparedness

Task leader: UoN

This task aims to provide an overview of the perceived and legal roles and responsibilities as well as underlying norms and values that organize different actors' involvement disaster (risk) management. This will be based on findings from task 1.1 and as well as document analysis and expert interviews (in person and via phone, or video conferences).

Task 1.5: Report risk perception and preparedness

Task leader: UoN

This task draws together the findings from the previous Tasks 1.1 to 1.4 in a report. The report provides suggestions for further discussion and identifies gaps in knowledge. It will provide input for WP2 and WP3.