

**Notfallerfahrung und Notfallwissen –
die Zusammenhänge mit Risikowahrnehmung und Disstress bei Notfällen und
Katastrophen.**

In a u g u r a l d i s s e r t a t i o n

zur

Erlangung des akademischen Grades eines

doctor rerum naturalium (Dr. rer. nat.)

an der Mathematisch-Naturwissenschaftlichen Fakultät

der

Ernst-Moritz-Arndt-Universität Greifswald

vorgelegt von

Daniela Knuth

geboren am 15.06.1983

in Bad Saarow-Pieskow

Greifswald, 08.05.2014

Dekan: Prof. Dr. Klaus Fesser

1. Gutachter : Prof. Dr. Silke Schmidt

2. Gutachter: Prof. Dr. Gundula Hübner

Tag der Promotion: 20.10.2014

INHALTSVERZEICHNIS

Dissertationsstudien	i
1. Einleitung	1
2. Hintergrund	2
2.1 Prävention und Vorbereitung	2
2.2 Risikowahrnehmung	3
2.2.1 Risikowahrnehmung, Wissen und Erfahrung	4
2.2.2 Risikowahrnehmung und objektive Risikomaße	5
2.3 Kultur bzw. Nationalität	6
2.4 Stresserleben	6
2.5 Besonderheiten der Katastrophenforschung	8
3. Methode	8
3.1 Design und Datenerhebung	8
3.2 Stichproben	9
4. Studienspezifisches Vorgehen und Ergebnisse	10
4.1 Studie 1 - Entwicklung des interkulturellen Fragebogens (2013)	10
4.2 Studie 2 - Risikowahrnehmung, Erfahrung und objektives Risiko (2014)	11
4.3 Studie 3 - Erfahrung und die Genauigkeit der Risikoeinschätzung (in press)	12
4.4 Studie 4 - Erfahrung, Notfallwissen und Distress (2013)	13
5. Diskussion	15
5.1 Risikowahrnehmung und Notfallenerfahrung	16
5.2 Distress und Notfallenerfahrung	18
5.3 Notfallwissen, Distress und Risikowahrnehmung	18
5.4 Limitationen	19
6. Fazit und Ausblick	20
7. Literatur	ii

Anhang	ii
Anhang A: Studie 1	iii
Anhang B: Studie 2	iv
Anhang C: Studie 3	v
Anhang D: Studie 4	vi
Erklärung des Eigenanteils	vii
Eigenständigkeitserklärung	ix

Dissertationsstudien

Studie 1: Entwicklung des interkulturellen Fragebogens

Knuth, D., Kehl, D., Galea, E., Hulse, L., Sans, J., Vallès, L., Roiha, M., Seidler, F., Diebe, E., Kecklund, L., Petterson, S., Wolanin, J., Beltowski, G., Preiss, M., Sotolároová, M., Holubová, M., Sofuoglu, T., Baskaya Sofuoglu, Z., Pietrantoni, L., Saccinto, E. & Schmidt, S. (2013). BeSeCu-S – a self-report instrument for emergency survivors. *Journal of Risk Research*. doi: 10.1080/13669877.2013.815649

Studie 2: Risikowahrnehmung, Erfahrung und objektives Risiko

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (in press). Risk perception, experience and objective risk: A cross-national study with European emergency survivors. *Risk Analysis*. doi: 10.1111/risa.12157

Studie 3: Erfahrung und die Genauigkeit der Risikoeinschätzung

Knuth, D., Kehl, D., Hulse, L., Spangenberg, L., Brähler, E. & Schmidt, S. (in press) Risk perception and emergency experience: Comparing a representative German sample with German emergency survivors. *Journal of Risk Research*

Studie 4: Erfahrung, Notfallwissen und Distress

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2013). Perievent distress during fires - The impact of perceived emergency knowledge. *Journal of Environmental Psychology*, 34, 10–17. doi: <http://dx.doi.org/10.1016/j.jenvp.2012.12.002>

1. Einleitung

Notsituationen wie Brände, Erdbeben oder Hochwasser sind Ereignisse, die sich insbesondere durch plötzliches und meist unvorhersehbares Auftreten auszeichnen (United Nations Department of Humanitarian Affairs, 1992). Um die negativen Auswirkungen solcher Ereignisse zu reduzieren, müssen Handlungen sowie Reaktionen zumeist in kurzer Zeit und unter möglicherweise großem Stress durchgeführt werden (Lazarus & Folkman, 1984; Proulx, 1993). Aus diesem Grund kommt den Bereichen der Prävention und Vorbereitung eine besondere Bedeutung zu, da diese die Handlungssicherheit möglicherweise erhöhen und die negativen Konsequenzen verringern können (BBK, 2011).

Sowohl das ereignisbezogene Wissen als auch das wahrgenommene Risiko in Bezug auf das Eintreten eines möglichen Ereignisses bzw. dessen negative Auswirkungen gelten als wichtige Startkomponenten des Prozesses zur Initiierung von präventiven Verhaltensweisen bzw. vorbereitenden Handlungen (Armitage & Conner, 2000; Renner, 2003; Weinstein, 1988). Ereignisspezifisches Wissen ist ein wichtiger Faktor zu Beginn dieses Prozesses, welcher vorhanden sein sollte, um sich mit etwaigen Präventionsmaßnahmen auseinandersetzen zu können (Weinstein, 1988). Dieses Wissen kann sowohl theoretisch, zum Beispiel durch eine gedankliche Auseinandersetzung mit dem Thema oder auch Training, als auch praktisch, in Form von direkter Erfahrung mit einer solchen Situation, erlangt werden (Kasperson et al., 1988; Lindell & Hwang, 2008). Ist Wissen in Bezug auf ein Ereignis vorhanden, so muss eruiert werden, welche Relevanz diese Informationen für die eigene Person haben. Ist es also wahrscheinlich, selbst von einem solchen Ereignis oder den negativen Konsequenzen betroffen zu sein (Weinstein, 1988)? Die direkten Zusammenhänge zwischen Risikowahrnehmung und Vorsorgeverhalten werden kontrovers diskutiert (Bubeck, Botzen, & Aerts, 2012; Tekeli-Yesil, Dedeoglu, Braun-Fahrlaender, & Tanner, 2010), doch auch wenn Risikowahrnehmung nicht als hinreichender Faktor für Vorsorgeverhalten anzusehen ist, so ist sie doch ein notwendiger, um weitere Phasen des Prozesses zu initiieren (Renner, 2003).

Mit den vorliegenden Studien dieser Arbeit werden die Einflüsse von sowohl theoretischem Wissen als auch praktischer Notfallenerfahrung auf die Risikowahrnehmung für verschiedene Notsituationen und in Bezug auf die emotionalen Reaktionen während eines solchen Ereignisses untersucht. Hierbei wird geprüft, welchen Einfluss die direkte Notfallenerfahrung bei Notfallbetroffenen und das vorherige Notfallwissen auf die zukünftige Risikowahrnehmung haben. Darüber hinaus wird untersucht, ob mögliche Effekte ereignisspezifisch sind oder, ob eine spezifische Notfallenerfahrung möglicherweise einen Einfluss auf das wahrgenommene Risiko für andere Ereignisse hat. Des Weiteren wird der Einfluss von Notfallenerfahrung auf die Genauigkeit der Risikoschätzung untersucht. Mit der letzten Studie wird insbesondere der Zusammenhang von sowohl Notfallenerfahrung als auch Notfallwissen mit den emotionalen Stressreaktionen während eines Ereignisses untersucht.

2. Hintergrund

Dem Bereich der Notfall- und Katastrophenforschung wurde in den vergangenen Jahren, nicht zuletzt durch die Terroranschläge 2001 in New York, 2004 in Madrid oder 2005 in London, vermehrt Aufmerksamkeit geschenkt. Weltweit waren im Jahr 2010 ca. 217.000.000 Menschen von den Auswirkungen von Naturkatastrophen betroffen und ca. 297.000 verloren durch diese ihr Leben (Guha-Sapir, Vos, Below, & Ponserre, 2010). Eine Unterscheidung zwischen den Begriffen *Notfallsituation* und *Katastrophe* erfolgt meist über die benötigten Ressourcen zur Bewältigung des Ereignisses. Eine Notfallsituation wird als ein plötzlich auftretendes und meist unvorhersehbares Ereignis definiert, welches sofortige Maßnahmen zur Verminderung der negativen Konsequenzen erfordert (United Nations Department of Humanitarian Affairs, 1992). Eine Katastrophe kann als eine Notfallsituation angesehen werden, welche umfassende menschliche, materielle oder ökologische Verluste zur Folge hat und bei deren Bewältigung lokale Ressourcen nicht ausreichend sind (United Nations Department of Humanitarian Affairs, 1992). Im Folgenden umfasst die Bezeichnung *Ereignis* sowohl Notfallsituationen als auch Katastrophen.

Im Bereich des Notfall- und Katastrophenmanagements wird eine Unterteilung von Ereignissen in verschiedene Phasen vorgenommen. Die verschiedenen Phasen sind hierbei als Zyklus bzw. als Prozess zu verstehen (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK), 2011). Vor dem Eintritt eines Ereignisses stehen hier die Phasen Prävention (*prevention*) und Vorbereitung (*preparedness*). Der Zyklus wird durch die Reaktionsphase (*response*) während des Ereignisses und die Phase der Bewältigung und des Wiederaufbaus (*recovery*) im Anschluss an ein Ereignis vervollständigt (BBK, 2011). Die Übergänge bzw. Grenzen zwischen den Phasen sind fließend und Aktivitäten in einer Phase können Auswirkungen auf die anderen Bereiche haben (Baird, 2010).

Da der Eintritt von Katastrophen und Notsituationen sowohl plötzlich als auch zumeist unvorhersehbar ist, kommt den Bereichen der Prävention und Vorbereitung eine besondere Bedeutung zu. Welche Faktoren Personen dazu bewegen, präventives Verhalten zu zeigen bzw. vorbereitende Handlungen durchzuführen, wurde insbesondere in Bezug auf die Ausführung von gesundheitsförderlichen Verhaltensweisen erforscht.

2.1 Prävention und Vorbereitung

In Phasenmodellen wird davon ausgegangen, dass Menschen sich bei der Aufnahme von Verhalten in qualitativ unterschiedlichen Phasen einer Verhaltensänderung oder -aufnahme befinden können (Armitage & Conner, 2000; Lippke & Renneberg, 2006; Maddux, 1993). Im Precaution Adoption Process Model (PAPM; Weinstein, 1988) werden insgesamt sieben verschiedene Phasen beschrieben. In der ersten Phase haben Personen keine Informationen bezüglich einer möglichen Gefährdung, während sie in der zweiten Phase diese bereits haben, aber sich selbst nicht als gefährdet ansehen (Brannon & Feist, 2007; Weinstein, Sandman, & Blalock, 2008). In der dritten Phase wird die eigene Gefährdung anerkannt, doch noch keine Entscheidung bezüglich gesundheitsförderlichem Verhalten bzw. Verhaltensänderungen getroffen (Armitage & Conner, 2000; Brannon & Feist, 2007; Weinstein et al., 2008). Nach der Entscheidung erfolgt nun entweder die Intentionsbildung, ein Verhalten zu ändern bzw. ein neues Verhalten zu initiieren und zu planen (vierte Phase) oder die Entscheidung, nicht zu

handeln, welche in einer eigenen fünften Phase abgebildet wird (Armitage & Conner, 2000; Brannon & Feist, 2007; Weinstein et al., 2008). Auch das Ausführen der jeweiligen intendierten bzw. geplanten Handlung wird in einer eigenen Phase, der Aktionsphase, beschrieben und gefolgt von der Phase der Aufrechterhaltung (Armitage & Conner, 2000; Brannon & Feist, 2007; Weinstein et al., 2008). Das sozialkognitive Prozessmodell gesundheitlichen Verhaltens (Health Action Process Approach; HAPA; Schwarzer, 1992) beschreibt die Aufnahme von Gesundheitsverhalten als einen Prozess, welcher aus zwei unterschiedlichen Phasen besteht: der motivationalen und der volitionalen Phase (Armitage & Conner, 2000). Insbesondere in der motivationalen Phase des Modells ist der Faktor Risikowahrnehmung besonders wichtig, um die Wahrscheinlichkeit zum Übergang in die weiteren Handlungsphasen zu erhöhen (Armitage & Conner, 2000; Lippke & Renneberg, 2006). Die subjektive Einschätzung, selbst durch die negativen Auswirkungen einer Handlung bzw. eines Nicht-Handelns betroffen zu sein, ist ein wichtiger Ausgangspunkt, um weitere Prozesse sowie protektives Verhalten zu initiieren (Renner, 2003). Wenn eine Person das Risiko, in der Zukunft selbst betroffen zu sein, als gering bzw. nicht existent einschätzt, dann ist es unwahrscheinlich, dass Verhaltensweisen aufgenommen werden, um diese negativen Folgen abzuwenden. Die Risikoeinschätzung kann somit als ein notwendiger Faktor zur Initiierung des Prozesses angesehen werden, der jedoch nicht hinreichend ist (Renner, 2003), da im Anschluss weitere Faktoren relevant sind. Die folgende Arbeit untersucht insbesondere die initialen Faktoren Risikowahrnehmung und Wissen, die zu Beginn eines Verhaltensprozesses von Bedeutung sind.

2.2 Risikowahrnehmung

Das Konzept der Risikowahrnehmung ist zu einem wichtigen Bestandteil der Forschung geworden (Cohen, Etner, & Jeleva, 2007; Fischhoff, 1995; Kasperson et al., 1988; Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978; Slovic, Fischhoff, & Lichtenstein, 1982). Der Begriff Risiko kann als potentielle Gefahr bzw. Wahrscheinlichkeit interpretiert werden, negative Konsequenzen von zumeist negativen oder potentiell schädlichen Handlungen oder Ereignissen zu erleben (Slovic & Weber, 2002). Obwohl quantitative Daten, wie z.B. Häufigkeitsstatistiken zur Berechnungen von objektiven Risiken, immer differenzierter zur Verfügung stehen, scheint die subjektive Risikoeinschätzung einen stärkeren Einfluss auf Entscheidungen und das tatsächliche Verhalten von Personen zu haben (Kasper, 1980). Risikowahrnehmung ist definiert als die subjektive Gefahreinschätzung von Personen (Slovic, 1987, 1999) bzw. als Wahrscheinlichkeit einer Gefahr (Gierlach, Bradley, & Beutler, 2010) und deren negativen Konsequenzen (Sjöberg, Moen, & Rundmo, 2004) ausgesetzt zu werden. Risiken sind Ereignisse oder Handlungen, deren Konsequenzen unsicher sind (Eiser, 2004) und die etwas vom Menschen Wertgeschätztes, wie z.B. Leben, Gesundheit oder Besitz, bedrohen (Sellke & Renn, 2011).

In der bisherigen Forschung werden drei große Paradigmen zur Beeinflussung der Risikowahrnehmung unterschieden: das psychometrische Paradigma (Slovic, Fischhoff, & Lichtenstein, 1980), die Theorie der sozialen Verstärkung von Risiken (SARF) (Kasperson et al., 1988) und die Kulturtheorie (Douglas & Wildavsky, 1982). Nach dem psychometrischen Paradigma wird die Risikowahrnehmung durch spezifische qualitative Merkmale des Ereignisses beeinflusst (Slovic et al., 1980). Je höher die wahrgenommene Bedrohung bzw.

das Katastrophenpotential eines Ereignisses eingeschätzt wird, und je geringer dessen wahrgenommene Kontrollierbarkeit durch die Person ist, desto höher ist die subjektive Risikoeinschätzung für dieses Ereignis (Gierlach et al., 2010; Slovic et al., 1980). Weitere wichtige Einflussfaktoren nach dem psychometrischen Ansatz sind die Vertrautheit und der Stand des Wissens bzgl. des Ereignisses (Slovic et al., 1980).

Die Theorie der sozialen Verstärkung von Risiken (SARF) (Kasperson et al., 1988) besagt, dass psychologische, soziale und kulturelle Prozesse mit Risiken interagieren und die Wahrnehmung dieser sowohl verstärken als auch reduzieren können. Insbesondere Informationen und deren Eigenschaften sind ein wichtiges Element der sozialen Verstärkung (Kasperson et al., 1988). Je höher der Umfang einer Information und deren Dramatisierung, desto wahrscheinlicher ist eine Verstärkung des Risikos (Kasperson et al., 1988). Auch Kontroversen bzgl. Risiken, die bereits in der Öffentlichkeit als hoch bzw. gefährlich eingeschätzt werden, können das wahrgenommene Risiko weiter erhöhen, da Zweifel bzgl. der Kenntnis des Sachverhaltes erhöht werden (Kasperson et al., 1988). Die Nutzung von Heuristiken im Umgang mit Informationen kann Personen helfen, den Informationsumfang zu reduzieren bzw. zu vereinfachen, was jedoch zu systematischen Fehlern führen kann (Kasperson et al., 1988). Auch die Bedeutung einer Information in sozialen Gruppen, der Signalwert eines Ereignisses und eine mögliche Stigmatisierung können die Interpretation einer Information beeinflussen (Kasperson et al., 1988). Die Kulturtheorie als drittes Paradigma hebt die Bedeutung eines Ereignisses in Bezug auf kulturelle Werte hervor (Douglas & Wildavsky, 1982). Je höher die Bedrohung von kulturellen Werten durch ein Ereignis, desto höher auch die subjektive Risikowahrnehmung bzgl. dieses Ereignisses (Douglas & Wildavsky, 1982).

2.2.1 Risikowahrnehmung, Wissen und Erfahrung

Der Einfluss von Informationen bzw. Wissen auf die mögliche Aufnahme von Gesundheitsverhalten bzw. Präventionsmaßnahmen wird insbesondere im Precaution Adoption Process Model (Weinstein, 1988) deutlich. Die erste Phase beschreibt Personen, die keinerlei Informationen bezüglich der Gefahr haben, wo hingegen Phase zwei die optimistische Verzerrung des eigenen Risikos beschreibt (Brannon & Feist, 2007; Weinstein et al., 2008). Wenn Personen also nie von einer Gefahr gehört haben oder von möglichen Handlungsoptionen diese zu verhindern, dann können sie auch keine Intention bezüglich dieser Verhaltensweisen bilden (Weinstein et al., 2008). Notfallwissen kann sowohl mit Hilfe von praktischer Erfahrung in Form von Notfallenerfahrung als auch durch Information oder einer thematischen Auseinandersetzung erworben werden. Die Theorie der sozialen Verstärkung von Risiken (SARF) betont sowohl den Einfluss von indirekten Erfahrungen, welche zumeist durch den Erhalt von Informationen über das Ereignis gewonnen werden, als auch die Wichtigkeit von direkter persönlicher Erfahrung (d.h. praktischem Wissen) mit einem Ereignis (Kasperson et al., 1988). Die Auswirkungen von direkter Erfahrung hängen hier in großem Maße vom jeweiligen Ereignis bzw. der jeweiligen Risikohandlung ab. So ist insbesondere beim Autofahren von einem beruhigenden Effekt auszugehen, wohingegen das Eintreten von Naturkatastrophen eher eine alarmierende Wirkung hat (Kasperson et al., 1988). In Bezug auf Unfälle und dramatische Ereignisse prognostiziert die Theorie eine Erhöhung

der Risikowahrnehmung auf Grund von Einprägbarkeit und Vorstellbarkeit des Ereignisses (Kasperson et al., 1988).

Vergangene Untersuchungen konnten zeigen, dass direkte Erfahrung mit einem Hochwasser (z.B. Kellens, Zaalberg, Neutens, Vanneuville, & Maeyer, 2011; Siegrist & Gutscher, 2006), einem Erdbeben (z.B. Kasapoglu & Mehmet, 2004) oder einem Buschbrand (Gow, Pritchard, & Chant, 2008) das wahrgenommene Risiko für dieses Ereignis erhöhen kann. Im Gegensatz dazu konnten Viscusi und Zeckhauser (2006) keinen signifikanten Einfluss von Erdbeben- und Hochwassererfahrung auf das wahrgenommene Risiko finden, und eine weitere Untersuchung ermittelte einen negativen Zusammenhang zwischen der direkten Erfahrung und dem zukünftigen wahrgenommenen Risiko (Halpern-Felsher et al., 2001). Neben dem spezifischen Effekt von Notfallenerfahrung auf das wahrgenommene Risiko stellt sich die Frage, ob Notfallenerfahrung auch einen Einfluss auf die Risikowahrnehmung für andere Ereignisse hat (d.h. Übertragungseffekt). Lindell und Hwang (2008) berichten zum Beispiel nicht nur positive Korrelationen zwischen Hochwassererfahrung und dem wahrgenommenen Risiko für Hochwasser, sondern ebenfalls zwischen Hochwassererfahrung und dem wahrgenommenen Risiko für Hurrikans und chemische Gefahren. Da in vergangenen Untersuchungen meist nur die Erfahrung mit einem spezifischen Ereignis erhoben wurde, lag der Fokus auf der Untersuchung der spezifischen Effekte von direkter Erfahrung, das heißt das Erleben eines potentiell schädlichen Ereignisses beeinflusst die Risikowahrnehmung für dieses Ereignis. Doch hat das Erleben darüber hinaus auch Auswirkungen auf das wahrgenommene Risiko für andere Ereignisse? Es fehlen Untersuchungen, die direkte Erfahrungen und Risikowahrnehmung in Bezug auf verschiedene Ereignisse mit gleicher Methodik erheben, um so zum einen mögliche Übertragungseffekte von Erfahrung zu untersuchen und zum anderen eine Vergleichbarkeit des Einflusses über verschiedene Ereignisse hinweg zu ermöglichen.

In Studie 2 sollen die Einflüsse von sowohl direkter Erfahrung als auch einer subjektiven Notfallwisseinschätzung auf die Risikowahrnehmung für verschiedene Ereignisse untersucht werden. Hierbei sollen auch etwaige Übertragungseffekte von Erfahrung untersucht werden.

2.2.2 *Risikowahrnehmung und objektive Risikomaße*

Im Gegensatz zur Risikowahrnehmung, der subjektiven Risikobeurteilung (Slovic, 1987, 1999), gibt es ebenso objektive Risikodaten, die häufig auf Experteneinschätzungen (Kellens et al., 2011) oder auch ereignisspezifischen Häufigkeitsstatistiken (Lichtenstein et al., 1978) basieren. Positive Zusammenhänge zwischen objektiven Risikodaten und der Risikowahrnehmung konnten in Bezug auf Hochwasser (z.B. Horney, MacDonald, Willigen, Berke, & Kaufman, 2010; Kellens et al., 2011), verschiedene Todesursachen (Lichtenstein et al., 1978) und Probleme wie Arbeitslosigkeit und Kriminalität (Loewenstein & Mather, 1990) identifiziert werden. Im Allgemeinen stimmt die Risikowahrnehmung jedoch nicht mit objektiven Daten überein (z.B. Hakes & Viscusi, 2004; Lichtenstein et al., 1978; Sjöberg, 2000). Neben dem postulierten positiven Zusammenhang zwischen Notfallenerfahrung und Risikowahrnehmung wird vermutet, dass Erfahrung mit einem Ereignis zu einer realistischeren Risikoeinschätzung führen kann (Sjöberg, 2000). Eine realistische Risikoeinschätzung und somit eine geringe bzw. keine Differenz zwischen objektiven

Risikodaten und Risikowahrnehmung kann wiederum die Mobilisierung von Vorsorgemaßnahmen wahrscheinlicher machen (Andersson, 2011; Lichtenstein et al., 1978). Darüber hinaus zeigte sich wiederholt, dass Frauen nicht nur eine höhere Risikowahrnehmung berichten als Männer (z.B. Andersson, 2011; Kellens et al., 2011), sondern ihr eigenes Risiko realistischer einschätzen bzw. dieses seltener unterschätzen als Männer (Andersson, 2011). Vergangene Untersuchungen fanden häufig keine Übereinstimmung zwischen Risikowahrnehmung und objektiven Risiken, doch positive Zusammenhänge konnten in Bezug auf Hochwasser gefunden werden.

Mit Hilfe von Studie 3 wurde die folgende Fragestellung untersucht: Welchen Einfluss hat die Notfallererfahrung auf die Genauigkeit der Risikoeinschätzung, und welchen Einfluss haben sowohl die Art des Ereignisses als auch das Geschlecht der Personen?

2.3 Kultur bzw. Nationalität

Auf Grund der Tatsache, dass einige Katastrophen multinationale Ereignisse sind bzw. sein werden (Lahad & Crimando, 2010), sollte auch ein möglicher Einfluss von Kultur auf die Reaktionen in einer Notsituation einbezogen werden. Eine Vielzahl der Studien, die notfallrelevante Faktoren untersuchen, stammt aus den USA, Kanada oder Australien (Briere & Elliott, 2000; Brown, 2003; Kobes, Helsloot, Vries, & Post, 2010a; Lindell & Perry, 2011) und somit aus möglicherweise sehr ähnlichen Kulturen. Da einige Forschungsergebnisse einen Einfluss von Kultur auf die Reaktionen bei einer Krisensituation vermuten lassen (Fothergill, Maestas, & Darlington, 1999; Rodríguez, Quarantelli, & Dynes, 2006), erfordert diese Fragestellung weitere Aufmerksamkeit. Ein internationaler Vergleich von Verhalten und psychischen Reaktionen über verschiedene Ereignisse hinweg ist jedoch schwierig, da einheitliche standardisierte Instrumente fehlen, und die Forschung sich meist auf ein spezifisches Ereignis bezieht. Somit sind lediglich Aussagen für dieses Ereignis möglich und Generalisierungen bzw. internationale Vergleiche kaum möglich (Briere & Elliott, 2000). In Bezug auf Risikowahrnehmung wurden nationale Unterschiede bezüglich des wahrgenommenen Risikos für Terrorismus beschrieben (d.h. höhere Werte für Personen aus Spanien, der Türkei und Großbritannien), welche möglicherweise durch das tatsächliche Auftreten dieser Ereignisse in der Vergangenheit erklärt werden könnten (Drakos & Müller, 2010).

Mit Hilfe von Studie 2 sollte die folgende Fragestellung untersucht werden: Könnten mögliche nationale Unterschiede in der Risikowahrnehmung für spezifische Ereignisse durch objektive Risikodaten erklärt werden?

2.4 Stresserleben

Da Notfallereignisse, wie z.B. Hausbrände, von Betroffenen meist in sehr kurzer Zeit verschiedene Entscheidungen fordern und häufig als bedrohlich oder potentiell schädlich interpretiert werden (Lazarus & Folkman, 1984; Lazarus, 1993), können Emotionen wie Angst oder Furcht ausgelöst werden, die dann wiederum zu Disstress, der negativen Form des Stresses, führen können (Lazarus & Folkman, 1984; Proulx, 1993). Disstress im Zusammenhang mit Notsituationen kann als intensive Angst, welche zumeist während oder sofort nach der Situationen eintritt (Birmes et al., 2005), definiert werden. In der Stresstheorie von Lazarus (Lazarus & Folkman, 1984; Lazarus, 1993) ist die Interpretation bzw. die

Bewertung eines Ereignisses bedeutender als das Ereignis selbst. Diese Interpretation beinhaltet sowohl mögliche Folgen des Ereignisses als auch die Bewertung der eigenen Fähigkeit zum Handeln bzw. Bewältigen der Situation (Lazarus & Folkman, 1984; Lazarus, 1993). Stresserleben während einer Notsituation ist weder eine ungewöhnliche noch eine zwangsläufig hinderliche Reaktion, da hierdurch eine angemessene Reaktion motiviert werden kann (Paulsen, 1984; Proulx, 1993). Nichtsdestotrotz haben bisherige Studien gezeigt, dass insbesondere posttraumatische Belastungssymptome durch erhöhten Disstress (Bernat, Ronfeldt, Calhoun, & Arias, 1998; Lawyer et al., 2006; Marmar, Weiss, Metzler, Ronfeldt, & Foreman, 1996) und vermehrte Paniksymptome (Ahern, Galea, Resnick, & Vlahov, 2004; Bernat et al., 1998; Bryant & Panasetis, 2001; Pfefferbaum, Stuber, Galea, & Fairbrother, 2006) in der Realisierungs- und Reaktionsphase vorhergesagt werden können. Intensive emotionale Reaktionen während der Notsituation und eine hohe subjektive Bedrohungswahrnehmung gehören zu den wichtigsten Prädiktoren einer posttraumatischen Belastungsstörung (PTBS) (Bovin & Marx, 2011; Ozer, Best, Lipsey, & Weiss, 2003). Im Rahmenmodell zur Ätiologie von Traumafolgen (Maercker & Michael, 2009) werden neben Ereignisfaktoren wie Traumadauer und Schadensausmaß auch insbesondere Faktoren vor einem Ereignis betont, wie zum Beispiel Soziodemografie, Persönlichkeit und auch die vorherige Erfahrung. Darüber hinaus wird die initiale Reaktion während eines Ereignisses als wichtiger Faktor beschrieben, welcher mit dem Ausmaß der Traumafolgen in Zusammenhang steht (Maercker & Michael, 2009).

Einen Versuch, Prädiktoren für den initialen Disstress während einer Notsituation zu identifizieren, unternahm Lawyer und seine Kollegen (Lawyer et al., 2006) in Bezug auf die Anschläge des 11. Septembers 2001. Sie fanden einen Einfluss von soziodemografischen Faktoren, bereits erlebten Stressoren und wahrgenommener Bedrohung (Sumer, Karanci, Berument, & Gunes, 2005) auf emotionalen Reaktionen und physiologische Erregung bei direkt und indirekt betroffenen Anwohnern New Yorks (Lawyer et al., 2006). Darüber hinaus wurden auch Faktoren wie Selbstwirksamkeit (Benight et al., 1999; Sumer et al., 2005) und die Vorbereitung auf die Situation in Form von Training (Marmar et al., 1996) als einflussreiche Faktoren identifiziert.

Die Stresstheorie von Lazarus (Lazarus & Folkman, 1984; Lazarus, 1993) betont die Bedeutung der Bewertung der eigenen Fähigkeit zum Handeln bzw. Bewältigen einer Situation. Ist diese wahrgenommene Fähigkeit hoch, so sollte die Ausprägung von Disstress geringer sein. Notfallenerfahrung sowie Notfallwissen könnten Faktoren sein, die diese wahrgenommene Fähigkeit erhöhen und somit möglicherweise den Disstress während der Ereignisse reduzieren. Ein Einfluss von Disstress in der Realisierungs- und Reaktionsphase auf posttraumatische Belastungssymptome wurde mehrfach nachgewiesen, doch prädiktive Faktoren für Disstress während eines Ereignisses sind nur selten untersucht worden. Darüber hinaus sind Studien mit Feuerbetroffenen sehr selten, obwohl diese Ereignisse, anders als z.B. schwere Erdbeben oder Hochwasser, in allen Ländern bzw. Regionen vorkommen und somit Menschen überall auf der Welt betreffen können.

Das Ziel von Studie 4 war die Untersuchung der folgenden Fragestellung: Welchen Einfluss haben sowohl wahrgenommenes Notfallwissen als auch vorherige Notfallenerfahrung auf den Disstress während eines Hausbrandes?

2.5 *Besonderheiten der Katastrophenforschung*

Eine besondere Herausforderung im Bereich der Katastrophenforschung sind sowohl das plötzliche Auftreten als auch die Unvorhersehbarkeit von Katastrophen und Notfällen (McFarlane & Norris, 2006; Norris, 2006). Darüber hinaus können insbesondere Katastrophen gleichzeitig eine große Anzahl Menschen betreffen (McFarlane & Norris, 2006). Insbesondere bei großen Ereignissen ist es wahrscheinlich, dass professionelle Hilfe nicht sofort für jeden verfügbar ist, und Betroffene zunächst allein handeln müssen (Goersch & Werner, 2011). Da die Handlungen der ersten Phase nach dem Eintritt eines Ereignisses den Schweregrad der Konsequenzen entscheidend beeinflussen können, kommt dem Bereich der Prävention und Vorsorge in der Katastrophenforschung eine besondere Bedeutung zu (Goersch & Werner, 2011). Die Übersichtsarbeit von Goersch und Werner (2011) fasst zusammen, dass 10 % der Unfallopfer durch fehlende oder fehlerhafte Erste-Hilfe Maßnahmen sterben. Weiterhin konnte die Zahl der Brandtoten in den USA durch den Einsatz von Rauchmeldern um 40 % gesenkt werden (Goersch & Werner, 2011).

Da die relevanten Faktoren und Reaktionen auf und im Speziellen während eines Ereignisses von außen nur schwer beobachtbar sind, werden in diesem Zusammenhang verschiedene methodische Ansätze genutzt. Evakuierungsübungen, der Einsatz von Szenarien (Kobes, Helsloot, Vries, & Post, 2010b; Nilsson, Johansson, & Frantzich, 2009) oder Computersimulationen (Galea, Owen, & Lawrence, 1996; Galea, 1998) können wichtige Hinweise liefern. Diese Simulationen von Evakuierungsvorgängen werden hier häufig als zu vereinfacht kritisiert, da das reale Verhalten von Personen nur selten Beachtung findet (Kuligowski, 2008; Vorst, 2010). Auch wenn die technischen Möglichkeiten für die Simulation von Verhalten während Notsituationen immer komplexer werden, so können diese die Realität nur wiedergeben, wenn tatsächliche Erlebnisse und Erfahrungen von Personen inkludiert werden (Kuligowski, 2008; Vorst, 2010). Dementsprechend haben verschiedene Studien gezeigt, dass Personen zum Beispiel nicht sofort auf einen Alarm reagieren und nicht, wie lange Zeit angenommen, mit der sofortigen Evakuierung beginnen (Ikeda, 1982; Samochine, Boyce, & Shields, 2005; Winerman, 2004; Zhao, Lo, Zhang, & Liu, 2009; Zimmerman & Sherman, 2011). In modernen Computerprogrammen werden diese Erkenntnisse zum Verhalten von Personen einbezogen (Galea et al., 1996; Gwynne, Galea, & Lawrence, 2006; Tao, Rui, Zhanhui, & Wenguo, 2007), doch dafür ist es wichtig, mehr über das Verhalten von Personen in Notfallsituationen und Katastrophen zu erfahren. Die Erhebung der Erfahrungen von direkt Betroffenen stellt somit eine der wichtigsten Informationsquellen dar. Für die Erhebung von tatsächlichen Erfahrungen haben sich insbesondere Interviews und Befragungen bewährt (McConnell et al., 2010; Rodríguez et al., 2006; Sime, 1983; Wang, 2009).

3. Methode

3.1 *Design und Datenerhebung*

Die Daten der beschriebenen Studien wurden mit Hilfe eines querschnittlichen Studiendesigns erhoben. Die Erhebung erfolgte mittels Selbstberichten in Form von Fragebögen, welche in einem konsekutiven Prozess in Zusammenarbeit mit Experten und Personen aus der Praxis entwickelt wurden (Knuth, Kehl, & Schmidt, 2013).

Notfallererfahrung wurde in Bezug auf die folgenden Ereignisse erhoben:

- *ein Brand in einem Wohnhaus oder öffentlichen Gebäude*
- *eine Flut bzw. ein Hochwasser*
- *ein Erdbeben*
- *einen Terroranschlag.*

Das Einschlusskriterium war das Erleben einer dieser Notsituationen.

Risikowahrnehmung wurde mit Hilfe der Frage: *Wie wahrscheinlich ist es Ihrer Meinung nach, dass Sie in der Zukunft ein Opfer der folgenden Notsituationen werden?* erfasst. Die Beantwortung erfolgte durch die Eingabe eines Prozentwertes und im Hinblick auf die folgenden Ereignisse: ein Hausbrand, ein Brand in einem öffentlichen Gebäude, eine Flut bzw. ein Hochwasser, ein Erdbeben, ein Terroranschlag und ein Verkehrsunfall.

Wahrgenommenes Notfallwissen vor dem Ereignis wurde zu Beginn der Befragung mit folgender Frage erhoben: *Bevor der Vorfall passierte, welches Wissen hatten Sie, das Ihnen in einem Notfall hätte nützlich sein können?* Die Einschätzung erfolgte mit Hilfe der folgenden 5-Punkt Likert-Skala 1=überhaupt nicht, 2=etwas, 3=mäßig, 4=ziemlich und 5=extrem in Bezug auf die Aussagen:

- *Ich hatte professionelles Wissen durch die Arbeit im Rettungsdienst.*
- *Ich hatte Kenntnisse in erster Hilfe durch einen Erste-Hilfe-Kurs.*
- *Ich hatte Wissen im Bereich Brandsicherheit durch die Arbeit als Brandmeister.*
- *Ich habe an Feualarmübungen in der Schule teilgenommen.*
- *Ich habe an Feualarmübungen in meiner Arbeitsstelle teilgenommen.*
- *Ich habe die Sicherheitshinweise/Rettungspläne in öffentlichen Plätzen gelesen, zum Beispiel in Hotelzimmern, Zügen usw.*
- *Ich hatte darüber nachgedacht, was passieren würde, wenn eine Notsituation an einem solchen Ort aufträte, und meinen eigenen Rettungsplan vorbereitet.*

Die Erhebung von emotionalem Disstress erfolgte über die Einschätzung der Aussagen: *Ich war nervös, Ich hatte Angst, Ich war frustriert, Ich fühlte mich gestresst, Ich war ruhig.* mit der oben genannten 5-Punkt Likert-Skala.

3.2 Stichproben

Grundlage für die Untersuchungen sind zum einen Notfallbetroffene, die im Rahmen des von der Europäischen Kommission geförderten BeSeCu (Behaviour, Security and Culture) Projektes befragt wurden und zum anderen Personen einer repräsentativen Bevölkerungsbefragung. Die multinationale Befragung im Rahmen des BeSeCu Projektes (Schmidt & Galea, 2013) erfolgte in folgenden Ländern: Deutschland, Italien, Polen, Schweden, Spanien, Tschechische Republik, Türkei und Vereinigtes Königreich. Einschlusskriterium war das Erleben einer der folgenden Notsituationen in einem der oben genannten Länder: ein Brand in einem Wohnhaus oder einem öffentlichen Gebäude, eine Flut bzw. ein Hochwasser, ein Erdbeben oder ein Terroranschlag. Darüber hinaus mussten Personen mindestens 18 Jahre alt sein, die Notsituation durfte nicht länger als 11 Jahre in der Vergangenheit liegen (d.h. nicht vor 1999), und Feuerwehr bzw. Notdienst mussten am Ereignis beteiligt gewesen sein. Insgesamt ergab sich eine Gesamtstichprobe von 1112 Personen, welche die oben genannten Kriterien erfüllte.

In der repräsentativen Bevölkerungsbefragung wurden von einem unabhängigen Markt- und Sozialforschungsinstitut (USUMA, Berlin) mittels Face-to-Face Interviews und Fragebögen insgesamt 2555 Personen befragt. Einschlusskriterien waren ein Mindestalter von 14 Jahren und ein ausreichendes Verständnis der deutschen Sprache. In die Untersuchung der Studie 3 gingen insgesamt 2413 Personen dieser Stichprobe ein, da alle Personen unter 18 Jahre ausgeschlossen wurden. Darüber hinaus wurde die Stichprobe nach Personen mit (n=165) und ohne (n=2248) Notfallereignissen unterschieden, um so eine genauere Untersuchung des Einflusses von Notfallereignissen zu ermöglichen.

4. Studienspezifisches Vorgehen und Ergebnisse

4.1 Studie 1 - Entwicklung des interkulturellen Fragebogens (2013)

Um die Beziehungen zwischen verschiedenen psychischen Reaktionen sowie Verhaltensweisen über die verschiedenen Phasen und Arten eines Ereignisses hinweg im internationalen Vergleich untersuchen zu können, wurde der BeSeCu-S (Behaviour, Security, Culture – Survivor) Fragebogen in einem mehrstufigen Prozess entwickelt. Der BeSeCu-S Fragebogen ist das Ergebnis einer Zusammenarbeit von Praktikern (wie z. B. Feuerwehrpersonal) und Forschern, wie sie im Bereich der Katastrophenforschung gefordert wurde (Fischer, 2008; Kasapoglu & Mehmet, 2004).

Hypothesen

1. Der BeSeCu-S Fragebogen lässt sich im multinationalen Gebrauch in seiner Güte belegen.
2. Der Fragebogen kann die Reaktionen auf eine Notfallsituation bzw. eine Katastrophe in verschiedenen Phasen erheben und ist für verschiedene Ereignisse geeignet.
3. Emotionale und kognitive Erfahrungen in der Realisierungsphase stehen in Zusammenhang mit Stresssymptomen nach einem Ereignis.
4. Verhaltensbezogene Reaktionen stehen in Zusammenhang mit der Evakuierungszeit und möglichen Verletzungen.
5. Notfallwissen vor dem Ereignis sowie Emotionen bzw. Kognitionen während des Ereignisses stehen in Zusammenhang mit verhaltensbezogenen Reaktionen während des Ereignisses.

Datenanalyse und Stichprobe

Die Überprüfung der Skalen in Bezug auf ihre Eignung für einen internationalen Gebrauch erfolgte mit Hilfe von konfirmatorischer Faktorenanalysen, sowie Reliabilitäts- (d. h. Cronbach's alpha) und Validitätsanalysen. Darüber hinaus wurden sowohl diskriminante als auch konvergente Validität mit Hilfe von Spearman Korrelationen untersucht. Friedman Tests sowie post hoc Analysen mit Hilfe des Wilcoxon-Vorzeichen-Rang-Tests dienten zur Untersuchung von Variablen mit Messwiederholung. Zur weiteren Überprüfung der Hypothesen wurden Mann-Whitney-U-Tests, Kruskal-Wallis-Tests sowie χ^2 -Tests durchgeführt. Insgesamt wurden alle 1112 Notfallbetroffenen in diese Untersuchung eingeschlossen.

Ergebnisse

Die Ergebnisse zeigten eine signifikante Variation von Disstress, der wahrgenommenen Bedrohung sowie der wahrgenommenen Kontrolle über die verschiedenen Phasen eines Ereignisses hinweg. Dieses Ergebnis unterstützt die Annahme, dass sich die Reaktionen von Betroffenen im Verlauf eines Ereignisses ändern und der BeSeCu-S geeignet ist, diese Veränderungen zu erfassen. Die fit-Indizes der konfirmatorischen Faktorenanalyse ergaben eine sehr gute Passung der Disstressskala und eine gute Passung in Bezug auf die Skala zur Erfassung von Notfallwissen. Sowohl die Ergebnisse zur diskriminanten und konvergenten Validität als auch Reliabilitätsanalysen in den jeweiligen länderspezifischen Substichproben bestätigten die gute Passung der Skalen. Die Analysen über die einzelnen Länder sowie die unterschiedlichen Notfälle hinweg unterstützen die Hypothesen 1 und 2, in welchen der multinationale Gebrauch, sowie die Erfassung von Reaktionen in verschiedenen Notfallsituationen und Katastrophen angenommen wurden. Die positiven Zusammenhänge von emotionalem Disstress und der wahrgenommenen Bedrohung mit posttraumatischen Stresssymptomen stützen Hypothese 3. Signifikante Zusammenhänge zwischen initialem Verhalten und der Zeit bis zum Beginn der Evakuierung, Verletzungen, vorheriges Notfallwissen sowie emotionale und kognitive Reaktionen während des Ereignisses unterstützen die Hypothesen 4 und 5. Darüber hinaus konnten weitere Beziehungen zwischen emotionalen und kognitiven Faktoren während des Ereignisses mit der Responsezeit (d.h. die Zeit bis mit zum aktiven Verlassen des Ortes) gefunden werden.

4.2 Studie 2 - Risikowahrnehmung, Erfahrung und objektives Risiko (2014)

Das Ziel dieser Studie war die Untersuchung des Einflusses von vorheriger Notfallenerfahrung und objektiven Ereignisdaten auf die notfallrelevante Risikowahrnehmung. Darüber hinaus sollte untersucht werden, ob in der Vergangenheit identifizierte nationale Unterschiede in der Risikowahrnehmung mit Hilfe der objektiven Ereignisdaten erklärt werden können.

Hypothesen

1. Die Erfahrung mit einem spezifischen Ereignis wird auch die Risikowahrnehmung für dieses spezifische Ereignis erhöhen.
2. Die Erfahrung mit einem spezifischen Ereignis wird auch die Risikowahrnehmung für andere Ereignisse beeinflussen (Übertragungseffekt).
3. Das objektive Risiko für ein Ereignis hat einen Einfluss auf die Risikowahrnehmung für dieses Ereignis.
4. Die Risikowahrnehmung wird sich zwischen den verschiedenen Ländern unterscheiden.

Datenanalyse und Stichprobe

Die Überprüfung der Hypothesen erfolgte mit Hilfe von Multilevel Analysen mit der jeweiligen Risikowahrnehmung als unabhängiger Variable. Darüber hinaus wurde das Land, in dem die Personen leben (d.h. Aufenthaltsland) als Level-variable der Kontextebene eingefügt und im Anschluss die zu untersuchenden Prädiktoren inkludiert. Das objektive Risiko wurde mit Hilfe von ereignis- und länderspezifischen Häufigkeitsstatistiken in Bezug auf die jeweilige Bevölkerungszahl des Landes berechnet. Grundlage für diese Untersuchung

waren insgesamt 1045 Notfallbetroffene. Personen aus dem Vereinigten Königreich mussten auf Grund einer zu geringen Gruppengröße von der Analyse ausgeschlossen werden.

Ergebnisse

Der positive Zusammenhang zwischen der Erfahrung mit einem spezifischen Ereignis und der zukünftigen Risikowahrnehmung für dieses spezifische Ereignis konnte für alle untersuchten Ereignisse gefunden werden (d.h. Brände, Hochwasser, Erdbeben und Terrorismus). Es wurden ebenso geringe Übertragungseffekte gefunden, so erhöhte sich die Risikowahrnehmung für einen Terroranschlag ebenfalls durch die Erfahrung eines Brandes in einem öffentlichen Gebäude. Darüber hinaus erhöhte die Erfahrung eines öffentlichen Brandes und auch eines Terroranschlages die Risikowahrnehmung für einen Verkehrsunfall. Darüber hinaus konnte auch ein positiver Zusammenhang zwischen Notfallwissen und der Risikowahrnehmung für alle untersuchten Ereignisse gefunden werden (d. h. Brände, Hochwasser, Erdbeben, Terrorismus und Verkehrsunfälle). Die Ergebnisse sprechen also sowohl für Hypothese 1 als auch für Hypothese 2. Im Einklang mit Hypothese 3 konnte ein signifikanter Einfluss von länderspezifischen objektiven Ereignisdaten auf die jeweilige Risikowahrnehmung für die Ereignisse Erdbeben und Terroranschläge gefunden werden. Zudem zeigte sich ein signifikanter Einfluss des Aufenthaltslandes in Bezug auf die Risikowahrnehmung für jedes Ereignis. Diese Ergebnisse stützen Hypothese 4. Der Effekt des Aufenthaltslandes wurde jedoch nach Inklusion der länderspezifischen objektiven Risikodaten in das Modell deutlich abgeschwächt.

4.3 Studie 3 - Erfahrung und die Genauigkeit der Risikoeinschätzung (in press)

In der folgenden Studie wurde der Einfluss von Notfallenerfahrung auf die Risikowahrnehmung untersucht. Aus diesem Grund wurden Personen mit Notfallenerfahrung aus Deutschland (BeSeCu Gruppe) mit den beiden Gruppen der repräsentativen Bevölkerungsstichprobe Deutschlands verglichen. Im Mittelpunkt dieser Untersuchung stand der Einfluss von Erfahrung und dem Geschlecht auf die Differenz zwischen Risikowahrnehmung und objektiven Ereignisdaten. Im Folgenden wird diese Differenz als Genauigkeit der Risikoeinschätzung bezeichnet.

Hypothesen

1. Personen mit vorheriger Notfallenerfahrung berichten eine höhere Risikowahrnehmung als Personen ohne diese Erfahrung.
2. Die Risikowahrnehmung unterscheidet sich von objektiven Risikomaßen. Die Risiken bezüglich Terrorismus und Erdbeben werden überschätzt, während das Risiko eines Brandes und eines Verkehrsunfalls unterschätzt wird.
3. Sowohl Geschlecht als auch Notfallenerfahrung könnte die Genauigkeit der Risikoeinschätzung beeinflussen.

Datenanalyse und Stichprobe

Zur Überprüfung des Einflusses von Erfahrung auf Risikowahrnehmung wurde eine Regressionsanalyse durchgeführt. Eine Gruppenvariable ermöglichte den Vergleich der repräsentativen Stichprobe (mit und ohne Notfallenerfahrung) mit den Notfallbetroffenen

Personen aus der BeSeCu Stichprobe. Das objektive Risiko wurde mit Hilfe von ereignisspezifischen Häufigkeitsstatistiken berechnet. Die Differenzen zwischen Risikowahrnehmung und den objektiven Risikowerten wurden mit Hilfe eines Einstichproben t-tests analysiert. Die Vergleiche der Differenzen zwischen den Gruppen wurden auf Grund der unterschiedlichen Gruppengrößen mit Hilfe des Kruskal-Wallis-Tests untersucht. In der folgenden Untersuchung lag der Fokus auf in Deutschland lebenden Notfallbetroffenen (n=201). Diese wurden mit den 2413 Befragten der repräsentativen Bevölkerungsbefragung verglichen.

Ergebnisse

Die Ergebnisse zeigten den in Hypothese 1 angenommenen Einfluss von Notfallererfahrung auf die spezifische Risikowahrnehmung. Die jeweilige Gruppe mit Notfallererfahrung gab ein höheres wahrgenommenes Risiko für das erlebte Ereignis an als Personen ohne diese Erfahrung. Der größte Einfluss von Erfahrung konnte für das Ereignis Hochwasser gefunden werden. Zusätzliche Analysen zeigten, dass insbesondere die Zeit seit dem letzten Hochwasser ein wichtiger Einflussfaktor für die Risikowahrnehmung bzgl. Hochwasser ist. Eine signifikante Überschätzung des allgemeinen Risikos konnte für Hochwasser und Terrorismus in allen Gruppen identifiziert werden. Das Risiko eines Hausbrandes und eines Verkehrsunfalles wurde in der Gruppe ohne vorherige Notfallererfahrung unterschätzt. Betroffene der BeSeCu Gruppe überschätzten auch diese Ereignisse, während Notfallbetroffene der Repräsentativstichprobe nur das Hausbrandrisiko unterschätzten und eine korrekte Schätzung bzgl. Verkehrsunfällen abgaben. Hypothese 2 konnte in der Stichprobe ohne vorherige Notfallererfahrung bestätigt werden, wohingegen die Ergebnisse für die Stichproben mit Notfallererfahrung nicht für alle Ereignisse hypothesenkonform waren. In Bezug auf Brände und Verkehrsunfälle kam es hier eher zu Überschätzungen bzw. zu korrekten Einschätzungen des Risikos. Auch Hypothese 3 konnte bestätigt werden, da sowohl das Geschlecht als auch der Faktor Erfahrung die Genauigkeit der Risikoschätzung beeinflussen. So zeigten sich in Bezug auf das Hochwasserrisiko große Effekte von Notfallererfahrung sowohl für Männer als auch für Frauen. Die Genauigkeit der Feuerrisikoeinschätzung unterschied sich hingegen zwischen Männern und Frauen. Erfahrung mit einem Feuer hatte lediglich für Männer einen Einfluss auf die Risikoschätzung. Insbesondere in den Gruppen ohne vorherige Feuererfahrung zeigte sich, dass Männer dieses Risiko eher unterschätzen, während Frauen es entweder korrekt einschätzen oder aber überschätzen.

4.4 Studie 4 - Erfahrung, Notfallwissen und Disstress (2013)

Das Ziel der folgenden Untersuchung war es, individuelle und notfallspezifische Prädiktoren für den spezifischen Disstress von Feuerbetroffenen zu untersuchen. Darüber hinaus sollten insbesondere der Einfluss von wahrgenommenem Notfallwissen und die Beziehungen der gefundenen Faktoren untereinander näher analysiert werden. In diesem Zusammenhang liegt ein spezifischer Fokus auf der Untersuchung von Disstress, welcher durch das Realisieren der Notsituation (ereignisinduzierter Disstress) hervorgerufen wird. Ein sekundäres Ziel ist die Untersuchung der Beziehungen dieser Faktoren nach ihren direkten und indirekten Wirkungen.

Hypothesen

1. Wahrgenommenes Notfallwissen und die wahrgenommene Fähigkeit, mit der Situation umzugehen reduzieren Disstress in der Realisierungsphase, während die wahrgenommene Bedrohung, weibliches Geschlecht und das Erleben von Paniksymptomen mit erhöhtem Disstress in dieser Phase einhergehen.
2. Zwischen Notfallwissen und der Fähigkeit, mit der Situation umzugehen, sowie zwischen der wahrgenommenen Bedrohung, Paniksymptomen und dem durch das Feuer induzierten Disstress werden positive Beziehungen angenommen.
3. Darüber hinaus wird angenommen, dass wahrgenommenes Notfallwissen sowie eine höhere wahrgenommene Fähigkeit, mit der Situation umgehen zu können, mit einer reduzierten wahrgenommenen Bedrohung während der Situation einhergeht.

Datenanalyse und Stichprobe

Zur Identifizierung der Prädiktoren von Disstress in der Realisierungsphase sowie ereignisinduziertem Disstress wurden multiple Regressionsanalysen durchgeführt. Ereignisinduzierter Disstress wurde durch die Differenz von Disstress in der Realisierungsphase und vor Beginn des Ereignisses gebildet. Anschließend erfolgte eine Pfadanalyse, um zum einen die Beziehungen zwischen den Prädiktoren für ereignisinduzierten Disstress zu identifizieren und zum anderen sowohl direkte als auch indirekte Wirkweisen darzustellen. Insgesamt konnten 574 Personen, welche einen Brand in einem Wohnhaus erlebten, in die Untersuchung eingeschlossen werden (Betroffene aus dem Vereinigten Königreich mussten auf Grund einer zu geringen Stichprobengröße ausgeschlossen werden).

Ergebnisse

Emotionaler Disstress in der Realisierungsphase wurde unter anderem positiv durch weibliches Geschlecht, geringere Bildung, wahrgenommene Bedrohung, wahrgenommenen Zeitdruck sowie erlebte Paniksymptome beeinflusst. Ein negativer Zusammenhang wurde mit den Faktoren Alter, Notfallwissen vor dem Ereignis und der wahrgenommenen Fähigkeit, mit der Situation umgehen zu können, gefunden. Ereignisinduzierter Disstress steht in positivem Zusammenhang mit der wahrgenommenen Bedrohung, erlebten Paniksymptomen sowie wahrgenommenem Zeitdruck und ist durch geringste Bildung und wahrgenommenes Notfallwissen vor dem Ereignis negativ beeinflusst. Die Ergebnisse für den Disstress in der Realisierungsphase stützen Hypothese 1. Darüber hinaus berichteten Personen aus Deutschland insgesamt weniger Disstress. Die Ergebnisse der Pfadanalyse zeigten, dass der wahrgenommene Zeitdruck positiv mit feuerinduziertem Disstress, erlebten Paniksymptomen und wahrgenommener Bedrohung in Zusammenhang steht. Darüber hinaus wurden positive Zusammenhänge zwischen der wahrgenommenen Bedrohung und erlebten Paniksymptomen sowie dem feuerinduzierten Disstress identifiziert. Auch die erlebten Paniksymptome stehen in einer positiven Beziehung zum feuerinduzierten Disstress. Negative Zusammenhänge wurden zwischen Notfallwissen und feuerinduziertem Disstress sowie zwischen Notfallwissen und dem wahrgenommenen Zeitdruck gefunden. Notfallwissen hatte den stärksten Gesamteffekt (d. h. direkt und indirekt über die Reduzierung des wahrgenommenen

Zeitdrucks) auf den feuerinduzierten Disstress. Die Hypothesen 2 und 3 konnten, mit Ausnahme der Beziehungen zwischen Notfallwissen und der wahrgenommenen Bedrohung sowie den angenommenen Beziehungen der wahrgenommenen Fähigkeit, mit der Situation umgehen zu können, bestätigt werden.

5. Diskussion

In den hier beschriebenen Studien wurden sowohl emotionale, kognitive als auch Verhaltensreaktionen von Personen untersucht, die einen Notfall bzw. eine Katastrophe erlebt haben. Die untersuchten Zusammenhänge wurden nicht in Bezug auf die Notfallenerfahrung mit einem einzelnen spezifischen Ereignis untersucht, sondern in die beschriebenen Untersuchungen gingen Personen ein, die eine Vielzahl verschiedener Ereignisse erlebt hatten. In der Vergangenheit waren derartige Vergleiche, insbesondere zwischen Nationen kaum möglich, da zum einen nur Einzelereignisse (z. B. ein ganz spezifischer Brand) untersucht wurden und zum anderen unterschiedliche Erhebungsinstrumente verwendet wurden. Die Ergebnisse der 1. Studie bildeten die Grundlage für die weiteren Untersuchungen. So konnte gezeigt werden, dass sowohl die Skala zur Erfassung des Disstresses als auch die Skala zur Erfassung von Notfallwissen gute bis sehr gute psychometrische Eigenschaften in den verschiedenen Ländern aufwiesen. Die gute Performance der Disstressskala im internationalen Vergleich konnte auch in einer Differential Item Functioning (DIF) Analyse bestätigt werden (Feuerherd, 2012). Das Befragungsinstrument integriert Faktoren, die bereits vor dem Eintreten eines Ereignisses vorhanden waren (*Prävention* und *Vorbereitung*), sowie Reaktionen während eines Ereignisses (*Reaktion; Realisierung* und *Evakuierung*) und die Folgen bzw. Konsequenzen (*Bewältigung* und *Wiederaufbau*) eines Ereignisses. Es ist von besonderer Bedeutung, dass sich Befragungen auch auf diese Phasen beziehen, da bei einer fehlenden Spezifizierung unklar ist, worauf sich die Angaben von Betroffenen beziehen oder, ob gar ein gemitteltetes Urteil abgegeben wird. Insbesondere emotionaler Disstress in der Realisierungsphase des Ereignisses stand im Zusammenhang mit Reaktionen nach einem Ereignis und sowohl kognitiven als auch verhaltensbezogenen Reaktionen während des Ereignisses. Die positiven Zusammenhänge von emotionalem Disstress und der wahrgenommenen Bedrohung mit posttraumatischen Stresssymptomen bestätigen die Ergebnisse einer Metaanalyse zu den Prädiktoren von PTBS (Ozer et al., 2003). Auch die signifikanten Zusammenhänge zwischen initialem Verhalten und der Zeit bis zum Beginn der Evakuierung, Verletzungen, vorherigem Notfallwissen sowie emotionalen und kognitiven Reaktionen während des Ereignisses sind im Einklang mit zuvor gefundenen Wechselwirkungen (Glenshaw, Vernick, Frattaroli, Brown, & Mallonee, 2008; Zhao et al., 2009). Die Ergebnisse deuten darauf hin, dass das Erleben und Verhalten in einer Notfallsituation bzw. einer Katastrophe durch eine Vielzahl verschiedenster Faktoren gekennzeichnet ist. Es konnte bestätigt werden, dass Reaktionen in einer Phase auch Auswirkungen auf das Erleben und Verhalten in anderen Phasen haben (Baird, 2010), und insbesondere der emotionale Disstress während eines Ereignisses mit einer Vielzahl dieser Faktoren in Zusammenhang steht.

5.1 *Risikowahrnehmung und Notfallenerfahrung*

Mit den Studien 2 und 3 wurden insbesondere die Einflussfaktoren auf die wahrgenommene Wahrscheinlichkeit von potentiell gefährlichen Ereignissen untersucht. Die 2. Studie konnte den Einfluss von direkter Erfahrung auf die Risikowahrnehmung für dasselbe Ereignis zeigen. Zusätzlich konnten für die Risikowahrnehmung bezüglich Terrorismus, Hochwasser und Verkehrsunfällen auch Übertragungseffekte durch die Erfahrung mit anderen Ereignissen identifiziert werden. Darüber hinaus zeigte sich eine erhebliche Reduzierung der Varianz zwischen den Ländern für die Risikowahrnehmung bezüglich Erdbeben und auch Terrorismus, wenn die objektiven länderspezifischen Risikodaten einbezogen wurden. Bezüglich Bränden, Verkehrsunfällen und Hochwasser gab es nur geringe Unterschiede in der Risikowahrnehmung zwischen den untersuchten Ländern, obwohl sich die länderspezifischen objektiven Risikomaße für diese Ereignisse teilweise deutlich unterschieden. Das objektive Risikomaß hatte bei diesen Ereignissen keinen signifikanten Einfluss auf die Risikowahrnehmung für das Ereignis. In Studie 3 wurde der Fokus auf den Einfluss von Geschlecht und Notfallenerfahrung auf die Genauigkeit der jeweiligen Risikoeinschätzung gelegt. Auch in dieser Untersuchung konnte ein positiver Zusammenhang zwischen Notfallenerfahrung und der spezifischen Risikowahrnehmung für das Ereignis gefunden werden. Darüber hinaus zeigte sich, dass der Einfluss von Erfahrung auf die Genauigkeit der Risikoschätzung nicht für jedes Ereignis gleich ist. So war der Effekt von Erfahrung für das Ereignis Hochwasser groß, während Feuererfahrung nur kleine und auf die männliche Stichprobe beschränkte Effekte auf die Genauigkeit der Risikoeinschätzung hatte.

Direkte Effekte

Der positive Zusammenhang von Notfallenerfahrungen und dem wahrgenommenen Risiko konnte in den Studien 2 und 3 bestätigt werden. Der positive Zusammenhang von Notfallenerfahrung und Risikowahrnehmung kann speziell durch das Nutzen von Heuristiken erklärt werden. Hier ist die Verfügbarkeitsheuristik (Tversky & Kahneman, 1973) zu nennen, welche besagt, dass Personen bei der Beurteilung von Ereignissen bzw. deren Wahrscheinlichen, die Leichtigkeit, mit welcher diese Ereignisse erinnert werden können, in das abgegebene Urteil einbeziehen. Kann ein solches Ereignis leicht bzw. schnell in Erinnerung gerufen werden (d. h. es ist kognitiv verfügbar), so wird seine zukünftige Eintrittswahrscheinlichkeit höher geschätzt (Tversky & Kahneman, 1973). Die direkte Erfahrung mit einem Ereignis wird als ein wichtiger Faktor beschrieben, der insbesondere diese Einprägsamkeit und Vorstellbarkeit des Ereignisses erhöht und so auch zu einer höheren Risikowahrnehmung bezüglich des Ereignisses führen kann (Kasperson et al., 1988).

Der Einfluss von vorheriger Erfahrung auf die Risikowahrnehmung war für die Ereignisse Hochwasser und Erdbeben besonders groß. Als mögliche Erklärung kann das Konzept der sozialen Risikoverstärkung herangezogen werden (Kasperson et al., 1988). Hier wird neben der direkten Erfahrung mit einem Ereignis auch die indirekte Erfahrung von Ereignissen, vermittelt durch die mediale Berichterstattung, als bedeutsam angesehen. Die mediale Berichterstattung ist häufig disproportional zu den tatsächlichen Häufigkeiten von Ereignissen. Seltene bzw. dramatische Ereignisse wie z. B. terroristische Anschläge oder Erdbeben werden sehr viel häufiger gezeigt und könnten so auch nach einer direkten

Erfahrung mit dem Ereignis über längere Zeit präsenter bleiben (Kasperson et al., 1988). Diesbezüglich kann auch argumentiert werden, dass die objektiven Risiken für die in den Medien vernachlässigten Ereignisse eventuell sehr viel schwieriger zu schätzen sind, da es weniger Informationen zu diesen Ereignissen gibt.

Darüber hinaus geht man im Konzept der sozialen Risikoverstärkung (Kasperson et al., 1988) davon aus, dass eine Interaktion von Risikoereignisse und sozialen Prozesse zu einer Veränderung des wahrgenommenen Risikos führen kann. So können insbesondere Ereignisse wie Hochwasser und Erdbeben dazu führen, dass von einem einzelnen Ereignis viele Menschen gleichzeitig betroffen sind und somit indirekte Erfahrungen über bekannte Personen zu einer weiteren Erhöhung der Risikowahrnehmung führen können. Zusätzlich könnten die Auswirkungen dieser Ereignisse in Form von z. B. Gebäudeschäden noch immer sichtbar sein und so die Präsenz des Ereignisses wiederum erhöhen.

Neben den bereits diskutierten Erklärungen für die Effekte von Notfallererfahrung auf die Risikowahrnehmung, zeigen die Ergebnisse der Studie 3, dass auch das Geschlecht ein wichtiger Faktor ist. In Bezug auf Informationsmaßnahmen und Risikokommunikation ist dieses Ergebnis von besonderer Bedeutung, sodass sich für Männer und Frauen unterschiedliche Zielvorgaben ergeben könnten. Da Männer, insbesondere ohne vorherige Notfallererfahrung, eher zur Unterschätzung des eigenen Risikos neigen, wäre in diesem Fall eine Erhöhung des wahrgenommenen Risikos nötig, um die Genauigkeit der Risikoschätzung zu steigern. Bei Frauen zeigte sich hingegen, dass diese das eigene Risiko seltener unterschätzen und es eher überschätzen. Für eine Erhöhung der Genauigkeit der Risikoschätzung wäre also in Bezug auf bestimmte Ereignisse eine Reduzierung des wahrgenommenen Risikos nötig. Allgemeine Informationsmaßnahmen zur Erhöhung der Risikowahrnehmung könnten bei Frauen zu einer weiteren Überschätzung des Risikos führen und somit möglicherweise einen gegenteiligen bzw. nicht gewünschten Effekt haben.

Übertragungseffekte

Neben den direkten Effekten von Notfallererfahrung auf die Risikowahrnehmung konnten auch Übertragungseffekte identifiziert werden. Die Erfahrung eines Brandes in einem öffentlichen Gebäude erhöhte auch die Risikowahrnehmung für einen Terroranschlag. Darüber hinaus erhöhte die Erfahrung eines Terroranschlages sowie die Erfahrung eines Brandes in einem öffentlichen Gebäude auch die Risikowahrnehmung für zukünftige Verkehrsunfälle. Es besteht die Möglichkeit, dass die Effekte auf die Risikowahrnehmung für Verkehrsunfälle durch die Hinzunahme der spezifischen Erfahrung mit diesem Ereignis nicht aufgetreten wären, doch diese Ergebnisse lassen vermuten, dass es etwas gibt, was diese Ereignisse gemeinsam haben. Ein gemeinsamer Faktor, welcher die genannten Effekte erklären könnte, ist der Kontext. Sowohl terroristische Anschläge, Brände in öffentlichen Gebäuden als auch Verkehrsunfälle werden zumeist in einem öffentlichen Setting bzw. im öffentlichen Raum erlebt. Wenn also eine Person bereits ein Ereignis in einem öffentlichen Setting erlebt hat, in dem die Umgebung eventuell nicht so vertraut war, so fällt es diesen Personen möglicherweise auch leichter sich vorzustellen, ein anderes Ereignis in einem ähnlichen Kontext zu erleben. Die Erfahrung mit einem Ereignis kann also möglicherweise nicht nur die Vorstellbarkeit des gleichen Ereignisses erhöhen und somit auch die Risikowahrnehmung für dieses Ereignis (Kasperson et al., 1988), sondern, bei ähnlichem

Kontext, auch die Leichtigkeit des Abrufs für ähnliche Ereignisse (Tversky & Kahneman, 1973). Auch die negativen Zusammenhänge von Hausbrand- und Erdbebenerfahrung mit der Risikowahrnehmung für Hochwasser könnte durch einen gemeinsamen Kontext erklärt werden. Der gemeinsame Kontext könnte im Falle dieser Ereignisse als eher privat bzw. nicht-öffentlich interpretiert werden. Es ist möglich, dass das Erleben eines Hausbrandes bzw. eines Erdbebens im privaten Haushalt zu bestimmten Sicherheitsmaßnahmen führte, welche ebenso in Bezug auf Hochwasser wirksam sein könnten (z.B. sichere Ausstattung, Baumaßnahmen, Notfallpläne) und somit das wahrgenommene Risiko für dieses Ereignis reduzieren.

5.2 *Disstress und Notfallenerfahrung*

In Studie 4 konnte kein direkter Einfluss von vorheriger Notfallenerfahrung auf den emotionalen Disstress während eines Brandes gefunden werden. Unter Berücksichtigung der Ergebnisse der Studien 2 und 3 könnte auch dieses Ergebnis für einen spezifischen Einfluss von Erfahrung sprechen. Die stärksten Effekte wurden in Bezug auf Hochwasser- und Erdbebenerfahrung identifiziert. In Studie 4 wurde jedoch ausschließlich der Disstress von Brandbetroffenen untersucht. Davon ausgehend, dass die Effekte von Hochwassererfahrung auch in Bezug auf Disstress stärker sind als der Effekt von Hausbranderfahrung, ist es möglich, dass bei einer Untersuchung von Hochwasserbetroffenen ein Effekt von Erfahrung auf Disstress zu finden ist. Darüber hinaus wurde Notfallenerfahrung in dieser Untersuchung als die Summe vorheriger Erfahrungen mit den genannten Ereignissen inkludiert. Da es hier um die Erfahrung vor dem eigentlichen, im Fragebogen beschriebenen, Ereignis ging, war die Anzahl der Personen mit einer solchen Vorerfahrung auch sehr viel geringer und ein möglicher Effekt sehr viel schwerer zu identifizieren.

5.3 *Notfallwissen, Disstress und Risikowahrnehmung*

Wahrgenommenes Notfallwissen wurde in diesen Untersuchungen durch sechs Items abgebildet, die sich auf vorherige Übungen bzw. eigene Auseinandersetzung mit dem möglichen Eintritt eines Ereignisses beziehen. In Bezug auf Risikowahrnehmung konnte in Studie 2 ein positiver Zusammenhang von dieser Art des Wissens für alle untersuchten Ereignisse gefunden werden, während in Studie 4 ein negativer Zusammenhang zwischen Notfallwissen und der Ausprägung von Disstress während eines Brandes identifiziert wurde. Die Operationalisierung von Notfallwissen ist eine subjektive Einschätzung des eigenen Wissens und somit keine objektive Angabe des Wissensstandes, welche z. B. durch einen Wissenstest gebildet werden könnte. Das untersuchte Notfallwissen in diesen Studien kann also in Bezug auf den Begriff Risikowahrnehmung auch als das wahrgenommene Notfallwissen bezeichnet werden. Die spezifische Untersuchung der 4. Studie zeigte, dass es einen negativen Zusammenhang zwischen vorherigem wahrgenommenen Notfallwissen und dem erlebten emotionalen Disstress in der Realisierungsphase eines Brandes gibt. Die Untersuchung verdeutlicht, dass insbesondere der Anstieg des emotionalen Disstresses nicht vorrangig durch soziodemographische Faktoren beeinflusst ist, wie in vergangenen Studien beschrieben (Lawyer et al., 2006), sondern sowohl von notfallrelevanten Faktoren vor einem Ereignis abhängt als auch mit weiteren kognitiven Reaktionen während des Ereignisses in Zusammenhang steht. Insbesondere der negative Zusammenhang zwischen dem

wahrgenommenen Notfallwissen und dem Anstieg des emotionalen Disstresses bei einem Brand kann für den Bereich der Prävention von großer Bedeutung sein, da diese Ereignisse meist durch Unvorhersehbarkeit sowie plötzlichen Eintritt gekennzeichnet sind, und Vorsorge und Vorbereitung somit besonders bedeutsam sind. Vergangene Untersuchungen zeigten, dass Notfalltraining das Verhalten verbessern kann (Hwang, Duchossois, Garcia-Espana, & Durbin, 2006; Zhao et al., 2009), ohne gleichzeitig einen Effekt auf das Wissen zu haben (Hwang et al., 2006; Proulx & Reid, 2006). Bei der Evaluation solcher Trainings erfolgte hier zumeist eine Bewertung des objektiven Wissensstandes, während das wahrgenommene Wissen nicht erhoben wurde. Es steht außer Frage, dass die objektive Einschätzung des Wissens im Bereich Notfallvorsorge ein wichtiger Faktor ist, welcher keinesfalls durch die hier gefundenen Ergebnisse in Frage gestellt werden soll. Darüber hinaus scheint es jedoch sinnvoll, auch die wahrgenommene Einschätzung des Notfallwissens zu beachten, da diese den induzierten Disstress reduzieren kann.

5.4 Limitationen

Die in den Studien erhobenen Daten basieren auf retrospektiven Selbstberichten in Form von Fragebögen. Erinnerungsverzerrungen können aus diesem Grund nicht vollständig ausgeschlossen werden. Vergangene Studien konnten allerdings zeigen, dass Erinnerungen, insbesondere in Bezug auf Katastrophen und Notfallsituationen (Stallings, 2007, p. 66), sowie emotionale Ereignisse (Burke, Heuer, & Reisberg, 1992; Ritchey, Dolcos, & Cabeza, 2008) sehr beständig sind. In einer Studie zu den Erfahrungen bezüglich Hurrikan Hugo (Norris & Kaniasty, 1992) zeigte sich, dass die Selbstberichte der Betroffenen insbesondere bezüglich erlittener Verluste und Vorbereitung, im Vergleich zu einer Befragung 10 Monate früher, sehr stabil waren. Auch experimentelle Untersuchungen haben eine hohe Korrelationen von momentanen und retrospektiven Emotionseinschätzungen gefunden (Barrett, 1997). Insbesondere direkt erlebte Ereignisse, im Gegensatz zum Erleben eines Ereignisses als Zeuge, werden mit hoher Konsistenz berichtet (Krinley, Gallagher, Weathers, Kutter, & Kaloupek, 2003). Auch wenn diese Ergebnisse eine Konsistenz der berichteten Erlebnisse nach Katastrophen und Notfallsituationen nahelegen, sind Langzeitstudien, welche auch einen längeren Zeitraum von mehreren Jahren einschließen, nötig, um die Stabilität der Berichte weiter zu erforschen. Im Mittel ereigneten sich die hier einbezogenen Ereignisse innerhalb der letzten drei Jahre und die Brandereignisse der Studie 2 vor circa zwei Jahren. Im Vergleich zu vergangenen Untersuchungen von Erlebnissen während eines Ereignisses (Brunet et al., 2001) kann die Zeit zwischen Ereignis und Befragung als eher kurz bezeichnet werden.

Insgesamt kann in den länderspezifischen Substichproben nicht von einer Repräsentativität ausgegangen werden. Die Generalisierbarkeit der gefundenen Ergebnisse ist aus diesem Grund unbekannt. In Studie 2 zeigten sich signifikante Unterschiede (jedoch nur kleine Unterschiedseffekte) bezüglich Alter, Familienstand, Bildung, Einkommen, deutsche Staatsangehörigkeit und Religion zwischen der repräsentativen Stichprobe Deutschlands und der Betroffenenstichprobe aus Deutschland. Die Betroffenenstichprobe Deutschlands war insgesamt jünger, häufiger Single, höher gebildet, gab ein höheres Einkommen an und ordnete sich häufiger keiner spezifischen Religion zu.

Da die Studienteilnahme freiwillig war, kann auch ein Selektionsbias nicht ausgeschlossen werden. Insbesondere Personen mit traumatischen Erfahrungen bzw. Personen, die nahe

Angehörige bei dem Ereignis verloren haben, könnten eine Studienteilnahme verweigert haben, um so Erinnerungen an das Ereignis zu vermeiden. Es ist also möglich, dass insbesondere der Disstress während und auch der Einfluss der Folgen eines Ereignisses unterschätzt wird. Auch in Bezug auf die Risikowahrnehmung kann ein möglicher Selektionsbias bedeutsam sein. Es ist möglich, dass insbesondere Personen mit einer hohen Risikowahrnehmung bezüglich zukünftiger Ereignisse an der Studie teilnahmen. Personen, die ein solches Ereignis in der Zukunft für wahrscheinlicher halten, könnten den Nutzen bzw. die Relevanz der Untersuchung als höher bewertet haben als Personen, die ein vergleichbares Ereignis für sehr unwahrscheinlich halten. Eine hohe Relevanz der Untersuchung ist ein wichtiges Kriterium, das die Wahrscheinlichkeit einer Teilnahme erhöht (Frohlich, 2002). Für einen Einfluss dieser Erklärung sprechen auch die gefundenen hohen Werte in der Risikowahrnehmung in der Betroffenenstichprobe aus Deutschland.

6. Fazit und Ausblick

Zusammenfassend konnten die Untersuchungen zeigen, dass die Effekte von Notfallererfahrung auf die Risikowahrnehmung nicht für alle Ereignisse gleich bzw. gleich stark sind. Darüber hinaus konnten sowohl Übertragungseffekte von Notfallererfahrung als auch spezifische Effekte auf die Risikowahrnehmung von Männern und Frauen identifiziert werden. Um die Effektivität von Risikokommunikation zu steigern, könnte diese für spezifische Subgruppen angepasst werden. Zukünftige Studien sollten hier auch die möglichen Einflüsse weiterer Faktoren wie z.B. der altersspezifischen Risikodaten einbeziehen. Darüber hinaus könnten die identifizierten Übertragungseffekte darauf hindeuten, dass der Kontext von Ereignissen eine wichtige Rolle spielt. Eine Einführung von Präventionsmaßnahmen und die gleichzeitige Thematisierung der Relevanz für Ereignisse mit vergleichbarem Kontext könnten effektiv sein und so möglicherweise die Bereitschaft erhöhen. Da sich die Ergebnisse auf querschnittliche Daten beziehen, wären insbesondere für die Effekte von Notfallererfahrung Längsschnittuntersuchungen wünschenswert, welche einen Vergleich von Risikowahrnehmung vor und nach der Erfahrung mit einem Ereignis ermöglichen. Auch im Hinblick auf die Effekte von wahrgenommenem Notfallwissen wären experimentelle Studien wertvoll, welche den Einfluss von Wissen prospektiv untersuchen. Insgesamt zeigten auch die hier berichteten Studien zur Risikowahrnehmung, dass nur ein geringer Teil der Varianz aufgeklärt werden konnte. Dies ist ein häufig gefundenes Ergebnis (Kellens, Terpstra, & De Maeyer, 2013) und zeigt, dass Risikowahrnehmung ein Konstrukt ist, das von einer Vielzahl verschiedener Faktoren abhängig ist. Darüber hinaus könnten zukünftige Untersuchungen einen Vergleich von wahrgenommenem und objektivem Wissen anstreben, um so mögliche Diskrepanzen zwischen diesen zu identifizieren. Es zeigte sich, dass das wahrgenommene Wissen ein wichtiger Faktor sein kann, um den Disstress in einer Notsituation zu reduzieren.

7. Literatur

- Ahern, J., Galea, S., Resnick, H. S., & Vlahov, D. (2004). Television images and probable posttraumatic stress disorder after September 11. *The Journal of Nervous and Mental Disease*, *192*(3), 217–226. doi:10.1097/01.nmd.0000116465.99830.ca
- Andersson, H. (2011). Perception of own death risk: an assessment of road-traffic mortality risk. *Risk Analysis*, *31*(7), 1069–82. doi:10.1111/j.1539-6924.2011.01583.x
- Armitage, C. J., & Conner, M. (2000). Social cognition models and health behaviour: A structured review. *Psychology & Health*, *15*(2), 173–189. doi:10.1080/08870440008400299
- Baird, M. E. (2010). *The “ Phases ” of Emergency Management* (p. 42). Memphis. Retrieved from <http://www.vanderbilt.edu/vector/research/emmgtp Phases.pdf>
- Barrett, L. F. (1997). The relationships among momentary emotion experiences, personality descriptions, and retrospective ratings of emotion. *Personality and Social Psychology Bulletin*, *23*(10), 1100–1110. doi:10.1177/01461672972310010
- Benight, C. C., Ironson, G., Klebe, K., Carver, C. S., Wynings, C., Burnett, K., ... Schneiderman, N. (1999). Conservation of resources and coping self-efficacy predicting distress following a natural disaster: A causal model analysis where the environment meets the mind. *Anxiety, Stress & Coping*, *12*(2), 107–126. doi:10.1080/10615809908248325
- Bernat, J. A., Ronfeldt, H. M., Calhoun, K. S., & Arias, I. (1998). Prevalence of traumatic events and peritraumatic predictors of posttraumatic stress symptoms in a nonclinical sample of college students. *Journal of Traumatic Stress*, *11*(4), 645–664. doi:10.1023/A:1024485130934
- Birmes, P. J., Brunet, Coppin-Calmes, D., Arbus, C., Coppin, D., Charlet, J.-P., ... Schmitt, L. (2005). Symptoms of peritraumatic and acute traumatic stress among victims of an industrial disaster. *Psychiatric Services*, *56*(1), 93–5. doi:10.1176/appi.ps.56.1.93
- Bovin, M. J., & Marx, B. P. (2011). The importance of the peritraumatic experience in defining traumatic stress. *Psychological Bulletin*, *137*(1), 47–67.
- Brannon, L., & Feist, J. (2007). *Health Psychology: An Introduction to Behavior and Health*. Belmont CA US WadsworthThomson Learning (6th ed.). Belmont: Wadsworth.
- Briere, J., & Elliott, D. (2000). Prevalence, characteristics, and long-term sequelae of natural disaster exposure in the general population. *Journal of Traumatic Stress*, *13*(4), 661–679. doi:10.1023/A:1007814301369
- Brown, J. M. (2003). Eyewitness Memory for Arousing Events: Putting Things into Context. *Applied Cognitive Psychology*, *17*(1), 93–106. doi:10.1002/Acp.848

- Brunet, A., Weiss, D. S., Metzler, T. J., Best, S. R., Neylan, T. C., Rogers, C., ... Marmar, C. R. (2001). The peritraumatic distress inventory: A proposed measure of PTSD criterion A2. *The American Journal of Psychiatry*, *158*(9), 1480–5.
- Bryant, R. A., & Panasetis, P. (2001). Panic symptoms during trauma and acute stress disorder. *Behaviour Research and Therapy*, *39*(8), 961–66. doi:10.1016/S0005-7967(00)00086-3
- Bubeck, P., Botzen, W. J. W., & Aerts, J. C. J. H. (2012). A review of risk perceptions and other factors that influence flood mitigation behavior. *Risk Analysis: An Official Publication of the Society for Risk Analysis*, *32*(9), 1481–95. doi:10.1111/j.1539-6924.2011.01783.x
- Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK). (2011). Risikomanagement. *Bevölkerungsschutz*, *2*, 1–60.
- Burke, A., Heuer, F., & Reisberg, D. (1992). Remembering emotional events. *Memory & Cognition*, *20*(3), 277–290. doi:10.3758/BF03199665
- Cohen, M., Etner, J., & Jeleva, M. (2007). Dynamic Decision Making when Risk Perception depends on Past Experience. *Theory and Decision*, *64*(2-3), 173–192. doi:10.1007/s11238-007-9061-3
- Douglas, M., & Wildavsky, A. B. (1982). *Risk and culture: an essay on the selection of technical and environmental dangers* (p. ix, 221 p.). Berkeley: University of California Press.
- Drakos, K., & Müller, K. (2010). On the Determinants of Terrorism Risk Concern in Europe. *Economics of Security Working Paper Series*, *36*(June).
- Eiser, J. R. (2004). *Public perception of risk I* (pp. 1–63). Sheffield.
- Feuerherd, M. (2012). *Differential Item Functioning Analysen in einer internationalen , interkulturellen und multizentrischen Untersuchung des*. Universität Greifswald.
- Fischer, H. W. (2008). *Response to disaster. Fact versus fiction and its perpetuation. The sociology of disaster*. (Vol. 3). Lanham, Maryland: University Press of America.
- Fischhoff, B. (1995). Risk Perception and Communication Unplugged: Twenty Years of Process. *Risk Analysis*, *15*(2), 137–45. doi:10.1111/j.1539-6924.1995.tb00308.x
- Fothergill, A., Maestas, E. G., & Darlington, J. D. (1999). Race, Ethnicity and Disasters in the United States: A Review of the Literature. *Disasters*, *23*(2), 156–73. doi:10.1111/1467-7717.00111
- Frohlich, M. T. (2002). Techniques for improving response rates in OM survey research. *Journal of Operations Management*, *20*(1), 53–62. doi:10.1016/S0272-6963(02)00003-7

- Galea, E. R. (1998). A General Approach to Validating Evacuation Models with an Application to EXODUS. *Journal of Fire Sciences*, 16(6), 414–436. doi:10.1177/073490419801600603
- Galea, E. R., Owen, M., & Lawrence, P. J. (1996). Computer modelling of human behaviour in aircraft fire accidents. *Toxicology*, 115(1-3), 63–78. doi:10.1016/S0300-483X(96)03495-6
- Gierlach, E., Bradley, E. B., & Beutler, L. E. (2010). Cross-Cultural Differences in Risk Perceptions of Disasters. *Risk Analysis*, 30(10), 1539–1549. doi:10.1111/j.1539-6924.2010.01451.x
- Glenshaw, M. T., Vernick, J. S., Frattaroli, S., Brown, S., & Mallonee, S. (2008). Injury Perceptions of Bombing Survivors - Interviews from the Oklahoma City Bombing. *Prehospital and Disaster Medicine*, 23(6), 500–506.
- Goersch, H. G., & Werner, U. (2011). *Empirische Untersuchung der Realisierbarkeit von Maßnahmen zur Erhöhung der Selbstschutzzfähigkeit der Bevölkerung*. (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, Ed.).
- Gow, K., Pritchard, F., & Chant, D. (2008). How close do you have to be to learn the lesson? Fire burns! *The Australian Journal of Disaster and Trauma Studies*, 2.
- Guha-Sapir, D., Vos, F., Below, R., & Ponserre, S. (2010). *Annual Disaster Statistical Review 2010 The numbers and trends. Review - Literature And Arts Of The Americas* (pp. 1–42). Brussels, Belgium: Université catholique de Louvain.
- Gwynne, S., Galea, E. R., & Lawrence, P. J. (2006). The introduction of social adaptation within evacuation modelling. *Fire and Materials*, 30(4), 285–309. doi:10.1002/fam.913
- Hakes, J. K., & Viscusi, W. K. (2004). Dead reckoning: demographic determinants of the accuracy of mortality risk perceptions. *Risk Analysis*, 24(3), 651–664. doi:10.1111/j.0272-4332.2004.00465.x
- Halpern-Felsher, B. L., Millstein, S. G., Ellen, J. M., Adler, N. E., Tschann, J. M., & Biehl, M. (2001). The role of behavioral experience in judging risks. *Health Psychology*, 20(2), 120–126. doi:10.1037//0278-6133.20.2.120
- Horney, J. A., MacDonald, P. D. M., Willigen, M. van, Berke, P. R., & Kaufman, J. S. (2010). Individual Actual or Perceived Property Flood Risk: Did it Predict Evacuation from Hurricane Isabel in North Carolina, 2003? *Risk Analysis*, 30(3), 501 – 11. doi:10.1111/j.1539-6924.2009.01341.x
- Hwang, V., Duchossois, G. P., Garcia-Espana, J. F., & Durbin, D. R. (2006). Impact of a community based fire prevention intervention on fire safety knowledge and behavior in elementary school children. *Injury Prevention*, 12(5), 344–346. doi:10.1136/ip.2005.011197
- Ikeda, K. 'I. (1982). Warning of disaster and evacuation behavior in a Japanese chemical fire. *Journal of Hazardous Materials*, 7(1), 51–62. doi:10.1016/0304-3894(82)87004-0

- Kasapoglu, A., & Mehmet, E. (2004). Comparative Behavioral Response to Future Earthquakes: The Cases of Turkey and USA. *Social Behavior and Personality*, 32(4), 373–382. doi:10.2224/sbp.2004.32.4.373
- Kasper, R. G. (1980). Perceptions of Risk and their effects on Decision Making. In R. C. Schwing & W. A. Albers Jr. (Eds.), *Societal Risk Assessment. How Safe is Safe enough?* (Vol. 1, pp. 71–84). New York: Plenum Press.
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., ... Ratick, S. (1988). The Social Amplification of Risk: A Conceptual Framework. *Risk Analysis*, 8(2), 177–187. doi:10.1111/j.1539-6924.1988.tb01168.x
- Kellens, W., Terpstra, T., & De Maeyer, P. (2013). Perception and communication of flood risks: a systematic review of empirical research. *Risk Analysis : An Official Publication of the Society for Risk Analysis*, 33(1), 24–49. doi:10.1111/j.1539-6924.2012.01844.x
- Kellens, W., Zaalberg, R., Neutens, T., Vanneuville, W., & Maeyer, P. de. (2011). An Analysis of the Public Perception of Flood Risk on the Belgian Coast. *Risk Analysis*, 31(7), 1055 – 68. doi:10.1111/j.1539-6924.2010.01571.x
- Knuth, D., Kehl, D., & Schmidt, S. (2013). Development of field study instruments BeSeCu-S and BeSeCu-FR. In S. Schmidt & E. Galea (Eds.), *Behaviour-Security-Culture. Human behaviour in emergencies and disasters: A cross-cultural investigation* (pp. 60–69). Lengerich: Papst Science Publishers.
- Kobes, M., Helsloot, I., Vries, B. de, & Post, J. G. (2010a). Building safety and human behaviour in fire: A literature review. *Fire Safety Journal*, 45(1), 1–11. doi:10.1016/j.firesaf.2009.08.005
- Kobes, M., Helsloot, I., Vries, B. de, & Post, J. G. (2010b). Exit choice, (pre-)movement time and (pre-)evacuation behaviour in hotel fire evacuation - Behavioural analysis and validation of the use of serious gaming in experimental research. *Procedia Engineering*, 3, 37–51. doi:10.1016/j.proeng.2010.07.006
- Krinsley, K. E., Gallagher, J. G., Weathers, F. W., Kutter, C. J., & Kaloupek, D. G. (2003). Consistency of Retrospective Reporting About Exposure to Traumatic Events. *Journal of Traumatic Stress*, 16(4), 399–409. doi:10.1023/A:1024474204233
- Kuligowski, E. D. (2008). *Modeling Human Behavior during Building Fires. Director* (pp. 1–21).
- Lahad, M., & Crimando, S. (2010). Preparing for the Next Generation of Disasters. *Journal of Jewish Communal Service*, 85(2/3), 320–330. Retrieved from http://www.xbrm.com/wp-content/uploads/2010/11/JJCS_Preparing...Dusasters_SummerFall-2010.pdf
- Lawyer, S. R., Resnick, H. S., Galea, S., Ahern, J., Kilpatrick, D. G., & Vlahov, D. (2006). Predictors of peritraumatic reactions and PTSD following the September 11th terrorist attacks. *Psychiatry*, 69(2), 130–41. doi:10.1521/psyc.2006.69.2.130

- Lazarus, R. S. (1993). From psychological stress to the emotions: A history of changing outlooks. *Annual Review of Psychology*, 44, 1–22. doi:10.1146/annurev.ps.44.020193.000245
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York (Vol. 116, p. 456). New York: Springer.
- Lichtenstein, S., Slovic, P., Fischhoff, B., Layman, M., & Combs, B. (1978). Judged Frequency of Lethal Events. *Journal of Experimental Psychology*, 4(6), 551–578. doi:10.1037/0278-7393.4.6.551
- Lindell, M. K., & Hwang, S. N. (2008). Households' perceived personal risk and responses in a multihazard environment. *Risk Analysis*, 28(2), 539–56. doi:10.1111/j.1539-6924.2008.01032.x
- Lindell, M. K., & Perry, R. W. (2011). The Protective Action Decision Model: Theoretical Modifications and Additional Evidence. *Risk Analysis*, 32(4), 616–632. doi:10.1111/j.1539-6924.2011.01647.x
- Lippke, S., & Renneberg, B. (2006). Theorien und Modelle des Gesundheitsverhaltens. In B. Renneberg & P. Hammelstein (Eds.), *Gesundheitspsychologie* (pp. 35–60). Heidelberg: Springer Medizin Verlag.
- Loewenstein, G., & Mather, J. (1990). Dynamic Processes in Risk Perception. *Journal of Risk and Uncertainty*, 3(2), 155–175. doi:10.1007/BF00056370
- Maddux, J. E. (1993). Social cognitive models of health and exercise behavior: An introduction and review of conceptual issues. *Journal of Applied Sport Psychology*, 5(2), 116–140. doi:10.1080/10413209308411310
- Maercker, A., & Michael, T. (2009). Posttraumatische Belastungsstörungen. In J. Margraf & S. Schneider (Eds.), *Lehrbuch der Verhaltenstherapie* (pp. 105–124). Springer Berlin Heidelberg. doi:10.1007/978-3-540-79543-8_6
- Marmar, C. R., Weiss, D. S., Metzler, T. J., Ronfeldt, H. M., & Foreman, C. (1996). Stress responses of emergency services personnel to the Loma Prieta earthquake interstate 880 freeway collapse and control traumatic incidents. *Journal of Traumatic Stress*, 9(1), 63–85. doi:10.1002/jts.2490090107
- McConnell, N. C., Boyce, K. E., Shields, T. J., Galea, E. R., Day, R. C., & Hulse, L. (2010). The UK 9/11 evacuation study: Analysis of survivors' recognition and response phase in WTC1. *Fire Safety Journal*, 45(1), 21–34. doi:10.1016/j.firesaf.2009.09.001
- McFarlane, A. C., & Norris, F. H. (2006). Definitions and Concepts in Disaster Research. In F. H. Norris, S. Galea, M. J. Friedman, & P. J. Watson (Eds.), *Methods for Disaster Mental Health Research* (pp. 3–19). New York: The Guilford Press.
- Nilsson, D., Johansson, M., & Frantzich, H. (2009). Evacuation experiment in a road tunnel: A study of human behaviour and technical installations. *Fire Safety Journal*, 44(4), 458–468. doi:10.1016/j.firesaf.2008.09.009

- Norris, F. H. (2006). Disaster Research Methods : Past Progress and Future Directions. *Journal of Traumatic Stress, 19*(2), 173–184. doi:10.1002/jts.20109
- Norris, F. H., & Kaniasty, K. (1992). Reliability of delayed self-reports in disaster research. *Journal of Traumatic Stress, 5*(4), 575–588. doi:10.1002/jts.2490050407
- Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin, 129*(1), 52–73. doi:10.1037/0033-2909.129.1.52
- Paulsen, R. L. (1984). Human behavior and fires: An introduction. *Fire Technology, 20*(2), 15–27. doi:10.1007/BF02384147
- Pfefferbaum, B., Stuber, J., Galea, S., & Fairbrother, G. (2006). Panic reactions to terrorist attacks and probable posttraumatic stress disorder in adolescents. *Journal of Traumatic Stress, 19*(2), 217–228. doi:10.1002/jts.20118
- Proulx, G. (1993). A stress model for people facing a fire. *Journal of Environmental Psychology, 13*(2), 137–147. doi:10.1016/S0272-4944(05)80146-X
- Proulx, G., & Reid, I. M. A. (2006). Occupant behavior and evacuation during the Chicago cook county administration building fire. *Journal of Fire Protection Engineering, 16*(4), 283–309. doi:10.1177/1042391506065951
- Renner, B. (2003). Risikokommunikation und Risikowahrnehmung. *Zeitschrift Für Gesundheitspsychologie, 11*(3), 71–75.
- Ritchey, M., Dolcos, F., & Cabeza, R. (2008). Role of amygdala connectivity in the persistence of emotional memories over time: An event-related fMRI investigation. *Cerebral Cortex, 18*(11), 2494–2504. doi:10.1093/cercor/bhm262
- Rodríguez, H., Quarantelli, E. L., & Dynes, R. (2006). *Handbook of Disaster Research*. New York: Springer.
- Samochine, D. A., Boyce, K. E., & Shields, T. J. (2005). An Investigation into Staff Behaviour in Unannounced Evacuations of Retail Stores – Implications for Training and Fire Safety Engineering. In I. A. for F. S. Science (Ed.), *Fire Safety Science* (Vol. 8, pp. 519–530). London: IAFSS Symposium 8. doi:10.3801/IAFSS.FSS.8-519
- Schmidt, S., & Galea, E. (2013). *Behaviour - Security - Culture (BeSeCu): Human behaviour in emergencies and disasters: A cross-cultural investigation*. Pabst, Wolfgang Science.
- Schwarzer, R. *Psychologie des Gesundheitsverhaltens* (1992). Göttingen [u.a.]: Hogrefe, Verl. für Psychologie.
- Sellke, P., & Renn, O. (2011). *Handbuch Umweltsoziologie*. doi:10.1007/978-3-531-93097-8
- Siegrist, M., & Gutscher, H. (2006). Flooding Risks: A Comparison of Lay People's Perceptions and Expert's Assessments in Switzerland. *Risk Analysis, 26*(4), 971 – 79. doi:10.1111/j.1539-6924.2006.00792.x

- Sime, J. D. (1983). Affiliative Behaviour During Escape to Building Exits . *Journal of Environmental Psychology*, 3(1), 21–41. doi:10.1016/S0272-4944(83)80019-X
- Sjöberg, L. (2000). Factors in risk perception. *Risk Analysis*, 20(1), 1–11. doi:10.1111/0272-4332.00001
- Sjöberg, L., Moen, B.-E., & Rundmo, T. (2004). Explaining risk perception. An evaluation of the psychometric paradigm in risk perception research. *Rotunde Publikasjoner Rotunde*, 84, 1–33.
- Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280–285. doi:10.1126/science.3563507
- Slovic, P. (1999). Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, 19(4), 689–701. doi:10.1111/j.1539-6924.1999.tb00439.x
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and Fears - Understanding Perceived Risk. In R. C. Schwing & W. A. Albers (Eds.), *Societal Risk Assessment. How Safe is Safe enough?* (pp. 181–216). New York: Plenum Press.
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1982). Why Study Risk Perception? *Risk Analysis*, 2(2), 83–93. doi:10.1111/j.1539-6924.1982.tb01369.x
- Slovic, P., & Weber, E. U. (2002). Perception of risk posed by extreme events. *Discussion at the Conference "Risk ..."*, 1–21.
- Stallings, R. A. (2007). Methodological Issues. In H. Rodríguez, E. L. Quarantelli, & R. Dynes (Eds.), *Handbook of Disaster Research* (pp. 56–82). New York: Springer Science+Business Media.
- Sumer, N., Karanci, A. N., Berument, S. K., & Gunes, H. (2005). Personal resources, coping self-efficacy, and quake exposure as predictors of psychological distress following the 1999 earthquake in Turkey. *Journal of Traumatic Stress*, 18(4), 331–42. doi:10.1002/jts.20032
- Tao, T., Rui, R., Zhanhui, S., & Wenguo, W. (2007). A new composite fire evacuation (CFE) model based on human behavior. In *Building Simulation 2007* (pp. 703–708).
- Tekeli-Yesil, S., Dedeoglu, N., Braun-Fahrlander, C., & Tanner, M. (2010). Factors Motivating Individuals to Take Precautionary Action for an Expected Earthquake in Istanbul. *Risk Analysis*, 30(8), 1181–1195. doi:10.1111/j.1539-6924.2010.01424.x
- Tversky, A., & Kahneman, D. (1973). Availability: A Heuristic for Judging Frequency and probability. *Cognitive Psychology*, 5(2), 207–232. doi:10.1016/0010-0285(73)90033-9,
- United Nations Department of Humanitarian Affairs. (1992). *Internationally agreed glossary of basic terms related to disaster management*. United Nations (p. 81). Geneva: United Nations.

- Viscusi, W. K., & Zeckhauser, R. J. (2006). National Survey Evidence on Disasters and Relief: Risk Beliefs, Self-Interest, and Compassion. *Journal of Risk and Uncertainty*, 33(1), 13–36. doi:10.1007/s11166-006-0169-6
- Vorst, H. C. M. (2010). Evacuation Models and Disaster Psychology. *Procedia Engineering*, 3, 15–21. doi:10.1016/j.proeng.2010.07.004
- Wang, L. (2009). Symptoms of Posttraumatic Stress Disorder Among Adult Survivors Three Months After the Sichuan Earthquake in China. *October*, 22(5), 444–450. doi:10.1002/jts.
- Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 7, 355–386. doi:10.1037/0278-6133.7.4.355
- Weinstein, N. D., Sandman, P. M., & Blalock, S. J. (2008). The Precaution Adoption Process Model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health Behavior and Health Education* (4th ed., pp. 123–147). San Francisco: Jossey-Bass.
- Winerman, L. (2004). fighting fire with psychology. *Monitor on Psychology*, 35(8), 28. Retrieved from <http://www.apa.org/monitor/sep04/fighting.aspx>
- Zhao, C. M., Lo, S. M., Zhang, S. P., & Liu, M. (2009). A post-fire survey on the pre-evacuation human behavior. *Fire Technology*, 45(1), 71–95. doi:10.1007/s10694-007-0040-6
- Zimmerman, R., & Sherman, M. F. (2011). To Leave an Area After Disaster: How Evacuees from the WTC Buildings Left the WTC Area Following the Attacks. *Risk Analysis*, 31(5), 787–804. doi:10.1111/j.1539-6924.2010.01537.x

Anhang

Anhang A: Studie 1

Knuth, D., Kehl, D., Galea, E., Hulse, L., Sans, J., Vallès, L., Roiha, M., Seidler, F., Diebe, E., Kecklund, L., Petterson, S., Wolanin, J., Beltowski, G., Preiss, M., Sotolárova, M., Holubová, M., Sofuoglu, T., Baskaya Sofuoglu, Z., Pietrantoni, L., Saccinto, E. & Schmidt, S. (2013). BeSeCu-S – a self-report instrument for emergency survivors. *Journal of Risk Research*. doi: 10.1080/13669877.2013.815649

Anhang B: Studie 2

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (in press). Risk perception, experience and objective risk: A cross-national study with European emergency survivors. *Risk Analysis*. doi: 10.1111/risa.12157

Anhang C: Studie 3

Knuth, D., Kehl, D., Hulse, L., Spangenberg, L., Brähler, E. & Schmidt, S. (in press) Risk perception and emergency experience: Comparing a representative German sample with German emergency survivors. *Journal of Risk Research*

Anhang D: Studie 4

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2013). Perievent distress during fires - The impact of perceived emergency knowledge. *Journal of Environmental Psychology*, 34, 10–17. doi: <http://dx.doi.org/10.1016/j.jenvp.2012.12.002>

Anhang A: Studie 1

Knuth, D., Kehl, D., Galea, E., Hulse, L., Sans, J., Vallès, L., Roiha, M., Seidler, F., Diebe, E., Kecklund, L., Petterson, S., Wolanin, J., Beltowski, G., Preiss, M., Sotolárová, M., Holubová, M., Sofuoglu, T., Baskaya Sofuoglu, Z., Pietrantonio, L., Saccinto, E. & Schmidt, S. (2013). BeSeCu-S – a self-report instrument for emergency survivors. *Journal of Risk Research*. doi: 10.1080/13669877.2013.815649

BeSeCu-S – a self-report instrument for emergency survivors

Daniela Knuth^{a*}, Doris Kehl^a, Ed Galea^b, Lynn Hulse^b, Jordi Sans^c, Lola Vallès^c, Malin Roiha^c, Frank Seidler^d, Eberhard Diebe^d, Lena Kecklund^e, Sara Petterson^e, Jerzy Wolanin^f, Grzegorz Beltowski^f, Marek Preiss^g, Marie Sotolárová^g, Marketa Holubová^g, Turhan Sofuoglu^h, Zeynep Baskaya Sofuoglu^h, Luca Pietrantonioⁱ, Elisa Saccintoⁱ and Silke Schmidt^a

^aDepartment of Health and Prevention, University of Greifswald, Greifswald, Germany; ^bSchool of Computing and Mathematical Sciences, University of Greenwich, London, UK; ^cInstitute of Public Safety of Catalonia, Barcelona, Spain; ^dHamburg Fire and Emergency Service Academy, Hamburg, Germany; ^eMan-Technology-Organisation (MTO-) Säkerhet AB, Stockholm, Sweden; ^fFaculty of Fire Safety Engineering, The Main School of Fire Service (SGSP), Warsaw, Poland; ^gPrague Psychiatric Centre, University of Prague, Prague, Czech Republic; ^hAssociation of Emergency Ambulance Physicians, Izmir, Turkey; ⁱDepartment of Education, University of Bologna, Bologna, Italy

(Received 9 May 2012; final version received 21 May 2013)

Little intercultural research with standardised instruments has been conducted regarding survivors' responses (i.e. their emotions, cognitions and activities) to emergency situations. Based on results from focus groups, with survivors and experts, as well as a pre-test, a standardised psychological instrument was developed: the BeSeCu-S (*Behaviour, Security, and Culture – Survivor*). The BeSeCu-S is a questionnaire for people who have experienced an emergency situation where lives and property were threatened and evacuation from a structure was a valid option. It is subdivided into four main stages of such an event: Beginning, Realisation, Evacuation and Aftermath. A total of 1112 survivors from eight different countries and five different emergency situations took part in the field study. The results indicate that the questionnaire can enable researchers to analyse survivors' responses in relation to pre-, peri- and post-event factors (e.g. emergency knowledge, time to begin evacuating, injuries and post-traumatic stress symptoms). Additionally, analyses across different nationalities, event types and stages of an event appear possible.

Keywords: emergency; behaviour; survivors

Background

In recent years, the field of disaster research has received more attention. As with man-made incidents like the bombings in Madrid in 2004 and London in 2005, the impact of natural disasters has been very severe. Europe has faced incidents like the floods of 2002 and 2010 in the Czech Republic, Germany and Poland, as well as the earthquakes in Italy in 2009 and Turkey in 1999 and 2010. In 2010, natural disasters caused more than 297,000 deaths worldwide, and another 217,000,000 people were affected (Guha-sapir et al. 2011). However, other, small-scale emergency

*Corresponding author. Email: daniela.knuth@uni-greifswald.de

events, such as building fires, particularly fires in domestic buildings, have also posed significant harm to people and property (Kobes and Groenewegen 2009).

Different instruments have been developed over the years in order to investigate responses to a traumatic, fearsome event that threatens lives. The Peritraumatic Distress Inventory (PDI; Brunet et al. 2001) has 13 items and focuses on emotional reactions as well as physiological stress reactions during the event. Dissociative reactions during an event like feelings of unreality, being detached from oneself, being confused or a change in sense of time can be assessed with the 10 items of the Peritraumatic Dissociative Experiences Questionnaire (PDEQ; Marmar, Weiss, and Metzler 1996). A meta-analysis (Ozer et al. 2003) revealed subjective psychological responses to an event like perceived life threat and peritraumatic emotions as being important predictors of the later occurrence of post-traumatic stress disorder (PTSD). In order to investigate post-traumatic stress following traumatic events, the Impact of Event Scale (IES) was developed (Horowitz, Wilner, and Alvarez 1979). The self-report instrument was revised by Weiss and Marmar (1997; the IES-R) and comprises the three subscales intrusion, avoidance and hyperarousal. Like the aforementioned peritraumatic measures, the IES-R assesses responses to the event in general, rather than responses to any specific aspects or moments relating to the event. Another similarity is that its items focus mainly on emotional, physiological and cognitive responses to the event, albeit ones occurring at a later point in time.

In events like terrorist attacks, floods, earthquakes and building fires, there is another type of peri-event response that is important: victims' activities. What individuals do when faced with a threat and in the moments afterwards can directly influence their chances of escaping danger and reaching a place of safety. Studies of behavioural responses during a disaster or small-scale emergency that threatens lives and property, and especially during a building evacuation, have usually been investigated in a single type of event (Kasapoglu and Mehmet 2004; McConnell et al. 2010; Proulx and Reid 2006; Zhao et al. 2009). Previous investigations have often focused on initial activities like searching for more information or ignoring threat cues and continuing with one's current task (e.g. Samochine, Boyce, and Shields 2005) as well as evacuation preparations such as collecting belongings (e.g. McConnell et al. 2010). Activities undertaken during this 'response phase' (Galea 2009) can not only delay the start of an individual's evacuation from a structure (Zhao et al. 2009) but also affect their risk of incurring physical injury (Glenshaw et al. 2008) and have been found to be influenced by factors like emotional distress (Zhao et al. 2009), perceived cues to the threat (Zhao et al. 2009) and prior emergency knowledge (Glenshaw et al. 2008; Zhao et al. 2009). Perceived control and urgency may possibly even be involved (Glenshaw et al. 2008; Zhao et al. 2009). However, such studies have highlighted a temporal factor, with victims' responses changing at different moments during the event (Glenshaw et al. 2008; McConnell et al. 2010; Zhao et al. 2009).

It would seem then that in order to better understand the effects of peri-event responses on well-being following a disaster or similarly threatening emergency situation, victims' emotions (i.e. feelings and physiological states), cognitions plus their activities would need to be investigated. Responses would also need to be investigated with respect to the different stages of the event. Such knowledge could be of use to professionals in various health and safety fields and help develop preventive and protective interventions. However, investigations of relationships between a

fuller range of peri-event responses and post-event outcomes are very rare, as are investigations of relationships between the range of peri-event responses, and existing measures like the PDI and PDEQ would not be adequate for this task. One study (Kaysen et al. 2005) that did look at peri-event emotions, cognitions and activities – albeit for emergencies involving only a single victim (i.e. females who had been robbed, sexually or physically assaulted) – not only found that certain activities and emotions were associated with perceived threat, but also that peri-event responses could differ according to the type of event experienced. Although Kaysen et al. (2005) did not examine responses at specific moments during the events, they nevertheless noted a temporal factor (event duration) as being important. Such findings support the notion that a more comprehensive examination of responses to threatening events is needed.

There is one further point to consider. The rise of globalisation and multicultural nations, and the fact that future large-scale threatening events are likely to be multinational events (Lahad and Crimando 2010), prompt the question of whether culture will impact psychological and behavioural responses during disasters and other emergency situations. Most studies addressing this issue have been carried out in the UK, the USA, Canada or Australia (Briere and Elliott 2000; Brown 2003; Kobes et al. 2010; Lindell and Perry 2011); cultures that might be very similar. However, some study results indicate that culture might have a possible influence on the behavioural response to a threatening event (Fothergill, Maestas, and Darlington 1999; Rodríguez, Quarantelli, and Dynes 2006) and thus requires proper attention. Yet a comparison between cultures, different types of events and relationships between peri-event responses is not possible, since no standardised instruments have been used and research usually focuses on one particular event, and therefore, one can only make assumptions regarding this specific incident (Briere and Elliott 2000).

In order to investigate relationships between different peri-event responses and post-event outcomes, across different stages of an event and different event types, and also between different nationalities, the BeSeCu-S (*Behaviour, Security, and Culture – Survivor*) questionnaire was developed. This was as part of the wider EU-funded BeSeCu Project, with research conducted by partners in eight different countries in Europe. The BeSeCu-S questionnaire was designed for survivors of any event that threatened lives and property and meant evacuation of a structure was a valid option. Topics and questions were presented chronologically (i.e. relevant to pre-event, peri-event and post-event factors) and collect data on a variety of variables related to the individual, to the event in question and to threatening events in general. It allows not only investigations of acute trauma-related constructs like emotional distress, panic attack symptoms, perceived threat and post-traumatic stress but also enables an investigation between these constructs and activities undertaken by individuals during the event. BeSeCu-S displays the result of cooperation between practitioners and researchers, as demanded by different disaster researchers, in order to compare experiences and include future needs (Fischer 2008; Kasapoglu and Mehmet 2004).

The BeSeCu-S was tested with over a thousand survivors from Germany, UK, Spain, Italy, Sweden, Poland, Czech Republic and Turkey. It was hypothesised that analyses would reveal the following outcomes: (1) The BeSeCu-S would be suitable for international use; (2) the BeSeCu-S would be suitable for capturing the experiences of survivors across different event types and across different stages of

an event; (3) survivors' peri-event responses (at least some emotional and cognitive responses) would be significantly associated with post-event stress; (4) peri-event responses (at least some activities) would be significantly associated with time to begin evacuating and injuries incurred; and (5) prior emergency knowledge as well as emotional and cognitive peri-event responses would be significantly associated with at least some peri-event activities.

Method

Questionnaire development

The questionnaire was developed in consecutive steps including qualitative and quantitative data approaches. In addition to the interdisciplinary BeSeCu team of researchers and end-users, national and international experts from different fields of security research as well as emergency evacuation and national accident investigation boards supported the process of item generation. A literature review revealed the main topics and preliminary structure for the focus groups and interviews with survivors and first responders. These sessions were carried out with 132 participants in all project-partner countries (i.e. Germany, UK, Spain, Italy, Sweden, Poland, Czech Republic and Turkey), and the most frequently reported answers were used in order to formulate a first set of items in relation to the aforementioned and newly formulated categories (Freitag, Grimm, and Schmidt 2011; Grimm et al. in press). A pretest with a convenience sample of 336 participants as well as 11 cognitive debriefing task participants (see Collins 2003; Eremenco, Cella, and Arnold 2005) was drawn in order to test feasibility, practicability and difficulty of items (Grimm, Hulse, and Schmidt 2012). As a result of these steps, a final questionnaire draft was developed in English; therefore, a translation into all corresponding languages of all partner countries (i.e. German, Spanish, Italian, Swedish, Polish, Czech and Turkish) was necessary using a forward-backward-forward translation technique (Hilton and Skrutkowski 2002; Petersen et al. 2005). The questionnaires were identical with respect to layout and design and available online and as a paper/pencil version. Regarding recruitment, each project partner was responsible for recruiting a nationwide sample in their own country and therefore applying the appropriate recruitment strategies (Knuth et al. 2013).

Participants

Participants were eligible for the study if they gave informed consent and met the following inclusion criteria: (1) experienced one of the following events: domestic fire, fire in a public building, flood, earthquake or terrorist attack; (2) at least 18 years of age; (3) knew that the emergency services attended the incident; and (4) the incident was no longer than 11 years ago (i.e. occurred not earlier than 1999). Criterion number three regarding the emergency services was not mandatory for earthquake, terrorist attack and flood survivors since it can be assumed that the emergency services are always involved in such events even though survivors might not have been in direct contact with them. Criterion four was chosen in order to include survivors of the Izmir earthquake of 1999. Furthermore, research regarding memory biases has found that memories are less biased in children at the age of seven and older (Bauer et al. 2007; Cordón et al. 2004; Pillemer 1998; Rubin 2000), and since participants had to be at least 18 years of age, this meant the

Table 1. Sample characteristics ($n = 1112$) with respect to participants' nationality.

	German		U.K.		Czech		Polish		Spanish		Swedish		Turkish		Italian		Other	
	<i>N</i>	%	<i>N</i>	%														
Incident	209	100	42	100	166	100	174	100	106	100	79	100	146	100	170	100	15	100
Fire in a home	134	64.1	17	40.5	88	53.0	109	62.6	40	37.7	72	91.1	74	50.7	43	25.3	8	53.3
Terrorist attack	0	0.0	12	28.6	0	0	0	0	29	27.4	0	0	5	3.4	1	0.6	3	20
Flood	43	20.6	3	7.1	63	38.0	45	25.9	1	0.9	0	0	0	0	17	10	0	0
Public building fire	31	14.8	10	23.8	15	9	20	11.5	36	34	7	8.9	30	20.5	21	12.4	4	26.7
Earthquake	1	0.5	0	0	0	0	0	0	0	0	0	0	37	25.3	88	51.8	0	0
Female gender	116	55.5	19	45.2	116	69.9	93	53.4	54	50.9	47	59.5	50	35.5	97	57.4	7	46.7
Migrant background	25	12.0	10	24.4	21	12.7	18	10.3	15	14.4	17	22.4	3	2.1	11	6.5	15	100
Relationship status																		
Single	42	20.2	9	21.4	30	18.1	39	22.5	19	17.9	26	33.3	34	23.8	48	28.4	4	26.7
Married	81	38.9	23	54.8	84	50.6	112	64.7	52	49.1	21	26.9	99	69.2	42	24.9	5	33.3
Relationship	70	33.7	7	16.7	19	11.4	10	5.8	24	22.6	22	28.2	0	0	75	44.4	1	6.7
Divorced	10	4.8	3	7.1	15	9	4	2.3	8	7.5	6	7.7	6	4.2	3	1.8	3	20
Widowed	5	2.4	0	0	18	10.8	8	4.6	3	2.8	3	3.8	4	2.8	1	0.6	2	13.3
Qualification																		
No or lowest	20	9.7	2	4.8	24	14.5	9	5.2	20	18.9	15	19.2	18	12.4	4	2.4	1	6.7
Intermediary	59	28.5	5	11.9	34	20.5	2	1.2	13	12.3	4	5.1	15	10.3	13	7.7	1	6.7
Higher secondary	64	30.9	10	23.8	68	41	99	57.2	25	23.6	31	39.7	55	37.9	68	40.5	6	40
University degree	64	30.9	25	59.5	40	24.1	63	36.4	48	45.3	28	35.9	57	39.3	83	49.4	7	46.7
Income < 70%	68	33.8	5	11.9	78	47.3	54	32.7	14	14.3	17	21.8	45	32.8	97	62.2	3	20
70% ≥ x ≤ 150%	91	45.3	11	26.2	63	38.2	93	56.4	46	46.9	34	43.6	48	35	52	33.3	12	80
Income > 150%	42	20.9	26	61.9	24	14.5	18	10.9	38	38.8	27	34.6	44	32.1	7	4.5	0	0
Age $M(SD)$	40.84(15.57)		42.10(13.89)		44.28(17.15)		39.85(12.99)		45.07(12.68)		47.65(20.07)		37.69(11.49)		32.53(13.55)		35.67(9.53)	

Note: The percentages of income are referenced to the country-specific annual net income in each participating country (GfK GeoMarketing 2008).

sample only included participants who were at least seven years of age at the time of the incident. A sample of 1130 survivors met the inclusion criteria. Table 1 presents the socio-demographic information of the participants ($N=1112$) that experienced the incident in one of the partner countries. Participants who experienced an event in other countries like the USA, Malaysia or Japan were excluded. The mean age of the sample was 40.40 years ($SD=15.27$) with ages ranging from 18 years to 96 years. The mean time since the event was 3.21 years ($SD=3.39$).

Measurement

The final BeSeCu-S questionnaire combines the findings from the cross-cultural focus groups and interviews, literature review, expert consultation and pretesting (Knuth, Kehl, and Schmidt 2013). A 5-point Likert scale ranging from 1 to 5 (1=not at all, 2=a little bit, 3=moderately, 4=quite a bit, 5=extremely) was adopted from the IES-R (Weiss and Marmar, 1997) and used for all items of the emergency knowledge, emotional distress and perceived threat scales mentioned below, since translated versions already existed in the languages of participating countries (Bergh Johannesson et al. 2006; Corapcioglu et al. 2006; Gargurevich et al. 2009; Juczyński and Ogińska-Bulik 2009; Maercker and Schützwohl 1998; Pielmaier and Maercker 2011; Preiss et al. 2004). The mean scores of these scales were calculated and used in analyses if at least 75% of the scale items were answered.

Select parts of the final BeSeCu-S are discussed here. The first part concerns pre-event variables of interest to this paper and the second peri- and post-event variables.

Part I – Background information

This section consisted of socio-demographic items (see Table 1). Migrant background was assessed with questions about the participant's country of birth, the participant's parents' country of birth, as well as the participant's citizenship (Schenk et al. 2006).

Additionally, participants' emergency knowledge prior to the event in question was addressed here with the Emergency Knowledge Scale (EKS). Participants were asked the following question: *Before the incident occurred, what knowledge did you have that would be of use in an emergency?* Seven different statements were used to assess emergency knowledge: *I had professional knowledge, gained from working for the emergency services; I had first aid knowledge, gained from a first aid course; I had fire safety knowledge, gained from being a warden/fire safety officer; I had taken part in fire drills at school; I had taken part in fire drills at work; I had read safety notices/evacuation plans in public places, such as in hotel rooms, train carriages, etc. and I had thought about what would happen if an emergency occurred in such a location and had prepared my own evacuation plan.*

Part II – The specific incident

Questions concerning the event were subdivided into four different stages: 1. Beginning, 2. Realisation, 3. Evacuation and 4. Aftermath.

(1) *Beginning*. The first stage related to the moment just prior to participants perceiving cues to the threat. Emotional distress was assessed as a proposed baseline level with respect to this stage using the Emotional Distress Scale (EDS). Participants were asked: *Before the incident occurred, what were your feelings?* and rated their emotional distress with respect to the following items: *I was nervous, I was scared, I was upset, I felt stress and I was calm* (reverse coded).

(2) *Realisation*. The second stage related to the time from when participants perceived cues to the threat and realised something was happening. Emotional distress was evaluated again using the EDS with respect to this stage now. It was also of interest to look at participants' responses with more emphasis on their physiological state. Thus, participants were asked whether they experienced the 13 symptoms (i.e. fast heartbeat, sweating, trembling/shaking, shortness of breath, feeling of choking, chest pain or discomfort, nausea or abdominal distress, feeling dizzy, feelings of unreality or being detached from oneself, fear of losing control or going crazy, fear of dying, numbness or tingling sensations, chills or hot flushes) from the *DSM IV* (American Psychiatric Association 2000) criteria for a panic attack. It was thought that such symptoms would be most evident at this stage of the event and so participants were only asked about this here. The sum of experienced symptoms was used as a score.

The subjective evaluation of threat was assessed with the Perceived Threat Scale (PTS). Participants were asked the following two questions that were combined for the PTS: *When you realised you were in an emergency situation, did you think your own life was in danger?* and *When you realised you were in an emergency situation, did you think the lives of your family/friends were in danger?*

Perceived control was assessed with the following question: *When you realised you were in an emergency situation, did you think you were able to deal with the situation?*, which was rated on the aforementioned 5-point Likert scale.

Sense of urgency was primarily measured with a question about perceived time pressure (*Did you feel pressure to act fast (e.g. felt the situation could worsen at any moment)?*, yes/no). A second question (*How would you describe your behaviour when you understood something was happening?*) examined the sense of urgency further by exploring whether participants initially reacted in a more automatic manner, e.g. reverting to habitual behaviour, or whether they reacted in a more conscious manner, acting after reasoned deliberation. The answer options were *automatic/instinctive (reacted without thinking)* or *conscious/rational (thought first then reacted)*.

Initial activities were assessed as follows: *What was the first thing you did when you understood something was happening?* with the answer options: *I did nothing for a while; I tried to alert, comfort or save others who might be threatened by the situation; I tried to inform others about my situation, to reassure or update them; I sought help from the emergency services; I sought shelter inside the location; I tried to protect my property; I gave up and let happen whatever was about to happen; I gathered items in preparation for evacuation; I actively sought further information; Other*. Participants were asked to only choose one of these answers.

(3) *Evacuation*. The third stage concerned the individual's evacuation from the structure and was therefore only mandatory for participants that either self-evacuated or

had been rescued during the event. These participants were asked the following question: *Approximately how long did it take you to start evacuating/be rescued?* The answer options were as follows: *Within 30 s; Within 2 min; Within 5 min; Within 10 min; Within 30 min; Within 1 h; Within 5 h; Within 12 h; Within 24 h; More than 24 h.* Additionally, emotional distress, perceived threat and perceived control were assessed twice: once with reference to the period as they were making their way out of the structure and again at the end of this process (i.e. upon exiting the structure).

(4) *Aftermath.* The last stage contained questions regarding consequences of the event. Participants were asked: *Did you incur any physical injuries during the incident?* (yes/no).

In order to assess current post-traumatic stress symptoms resulting from the event, the IES-R (Weiss and Marmar 1997) was included. The 22-item self-report instrument asked participants to rate their distress level during the past seven days with respect to the specific incident they described in the questionnaire. A total IES-R score was derived by calculating the mean score on the 22 items.

Data analysis

Descriptive statistics were calculated. Scales were investigated using factor analyses (principal component analysis) with varimax rotation and Kaiser normalisation. The determinant of the *R*-matrix had to be greater than .00,001, while all *Corrected Item-Total Correlation* $\geq .3$ and reliability of each scale (Cronbach's α) had to be at least .7 (Field 2009). Confirmatory factor analysis was performed for each scale introducing the different nationalities as groups and using maximum likelihood estimation with AMOS. Goodness of fit for each scale can be investigated by a number of different parameters: the Comparative Fit Index (CFI) with proposed cut-off value of $\geq .95$ for good fit (Hu and Bentler 1999); the Incremental Fit Index (IFI) and the Goodness-of-Fit Index (GFI) with values $\geq .90$ indicating good fit (Meyers, Gamst, and Guarino 2006); the root mean square error of approximation (RMSEA) with values $\leq .06$ (Hu and Bentler 1999) or at least $\leq .10$ (Meyers, Gamst, and Guarino 2006) indicating good fit. After scale and construct validity analyses, Friedman tests, followed up with *post hoc* analyses using Wilcoxon signed-rank tests (with Bonferroni corrections applied), were conducted to assess and locate any significant variations for variables that were measured across three or more event stages. Finally, Spearman's rho, Mann-Whitney *U*-test, Kruskal-Wallis and Chi-squared tests were conducted to assess relationships between pre-, peri- and post-event variables (note, the last five categories for the time to begin evacuating variable were merged as few people reported starting to leave after 30 min). Data analyses were carried out using SPSS 19.0 and AMOS 19 computer software.

Results

The mean number of missing percentages varied across the questionnaire with 3.79% for the stage Beginning, 2.69% for the stage Realisation, 4.48% for the Evacuation stage and 5.63% for the last stage concerning the Aftermath.

Scale analysis

The investigation of scales with the factor analyses (principal component analysis) revealed a one-factor solution for all scales. With respect to these one-factor solutions, 46.55% of the total variance was explained in the EKS, 64.69% in the EDS and 80.55% in the PTS. Scales were also tested in a confirmatory factor analysis. Confirmatory factor analysis revealed very good values for the EDS [RMSEA=0.044 (0.035–0.052), GFI=0.948, CFI=0.961, IFI=0.961, $\chi^2=136.64$, $df=48$; $p<.001$]. For the EKS, the values were as follows: RMSEA=0.050 (0.040–0.055), GFI=0.900, CFI=0.873, IFI=0.876, $\chi^2=390.39$, $df=112$; $p<.001$. Table 2 shows descriptive scale characteristics and internal consistency values for all scales including their re-assessment through different stages. Internal consistency values (Cronbach's α) for the scales in the total sample were at least .7. These values were confirmed in the national subsamples for the EKS and EDS. The values of the PTS in the national samples of Spain and the UK were below the value of .7.

Discriminant and convergent validity

Discriminant validity was tested in all scales with respect to participants' current general health status and weeks since the incident given that these measures were conceptually different from the described scales (Brunet et al. 2001). Discriminant validity was considered verified if the correlation coefficient was smaller than .3. As can be seen in Table 3, the EKS, EDS as well as PTS at any time of the event showed no or only small correlations with weeks since the event and health status. Exceptions in the national subsamples were as follows: EKS with health status in the Spanish sample ($r_{rho} = -.37$, $p < .01$); EDS with health status in the Swedish (Beginning: $r_{rho} = .31$, $p < .01$) and Spanish (Realisation: $r_{rho} = .36$, $p < .01$; During Evacuation: $r_{rho} = .34$, $p < .01$) samples, and with weeks since the event in the Czech (Beginning: $r_{rho} = .39$, $p < .01$), Italian (Beginning: $r_{rho} = -.30$, $p < .01$) and Turkish (During Evacuation: $r_{rho} = .45$, $p < .01$) samples; PTS with health status in the UK (Realisation: $r_{rho} = .39$, $p < .05$; During Evacuation: $r_{rho} = .46$, $p < .01$), Spanish (During Evacuation: $r_{rho} = .30$, $p < .01$) and Swedish (During Evacuation: $r_{rho} = .33$, $p > .05$) samples, and with weeks since the event in the Turkish (Realisation: $r_{rho} = .45$, $p < .01$; During Evacuation: $r_{rho} = .45$, $p < .01$; Upon Exiting: $r_{rho} = .59$, $p < .01$) sample.

Table 2. Descriptive statistics and reliabilities for the three scales depending on their stage.

	α	M	SD	Items	α in national subsamples	α in incident subsamples
EKS – Beginning	.81	15.47	6.09	7	.66–.92	.76–.82
EDS – Beginning	.90	9.26	5.17	5	.70–.96	.75–.93
EDS – Realisation	.86	16.04	5.66	5	.78–.90	.81–.89
PTS – Realisation	.76	5.30	2.56	2	.33, .43, .69–.84	.54, .59, .72–.83
EDS – During evac.	.89	15.86	5.89	5	.82–.91	.79–.92
PTS – During evac.	.81	5.07	2.59	2	.51, .61, .78–.84	.57, .66–.86
EDS – Upon exiting	.88	15.30	5.75	5	.83–.92	.83–.90
PTS – Upon exiting	.78	3.80	2.21	2	.28, .59, .70–.91	.44, .64, .78–.80

Note. EKS=Emergency knowledge scale; EDS=Emotional distress scale; PTS=Perceived stress scale; evac. = evacuation

Table 3. Intercorrelations (Spearman-Rho) between pre-, peri- and post-event variables with respect to event stages.

1 EKS ^a	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2 EDS ^a	.02														
3 PTS ^b	-.07*	.12**													
4 EDS ^b	-.23**	.18**	.51**												
5 Panic ^b	-.12***	.16**	.41**	.60**											
6 Control ^b	.31**	-.12**	-.29**	-.45**	-.34**										
7 Evac starting ^c	-.07*	.13**	-.10**	-.03	-.01	-.06									
8 PTS ^c	-.06	.11**	.82**	.55**	.44**	-.28**	-.13**								
9 EDS ^c	-.24**	.19**	.57**	.88**	.59**	-.46**	-.04	.61**							
10 Control ^c	.27**	-.13**	-.32**	-.45**	-.37**	.72**	-.07*	-.35**	-.49**						
11 PTS ^d	-.07	.20**	.56**	.36**	.37**	-.26**	-.10**	.62**	.41**	-.28**					
12 EDS ^d	-.24**	.18**	.52**	.80**	.60**	-.43**	-.08*	.55**	.86**	-.47**	.46**				
13 Control ^d	.21**	-.16**	-.29**	-.38**	-.31**	.62**	-.02	-.29**	-.41**	.72**	-.32**	-.48**			
14 Weeks since event	-.13**	.02	.10**	.00	.00	-.11**	.12**	.03	.03	-.09*	.11**	.03	-.07		
15 Health	-.14**	.12**	.05	.09**	.11**	-.10**	.00	.04	.08*	-.09*	.08*	.10**	-.17**	-.03	
16 IES-R	-.10**	.22**	.47**	.57**	.49**	-.35**	.03	.52**	.64**	-.39**	.43**	.62**	-.40**	-.03	.18**

Note. * $p < .05$ ** $p < .01$.; ^a=Beginning; ^b=Realisation; ^c=During Evacuation; ^d=Upon Exiting; Health=current health status from 1 (very good) – 5 (very bad); Evac starting: 1=within 30 s – 6=more than 30 min

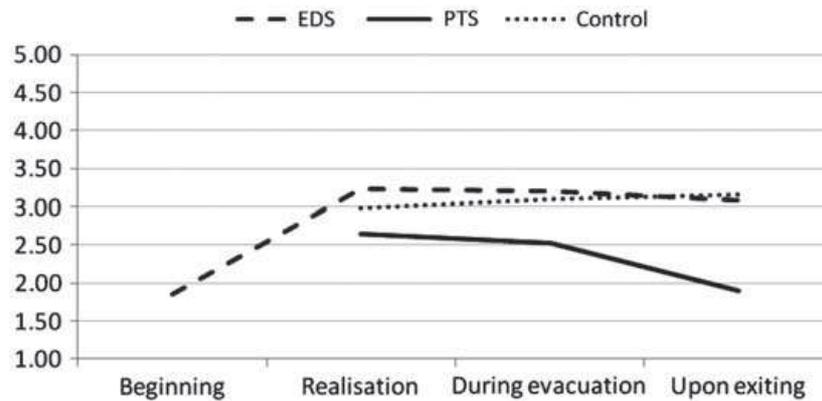


Figure 1. Stage variation of emotional distress (EDS), perceived threat (PTS) and perceived control.

For EDS and PTS, convergent validity was investigated with respect to the IES-R, since the latter measure also assesses emotional and cognitive responses to a threatening event. The overall correlation between EDS during the incident and the IES-R was significant and ranged from $r_{rho} = .57$ at Realisation to $r_{rho} = .64$ During Evacuation. For the PTS, the correlation with the IES-R was significant and ranged from $r_{rho} = .43$ Upon Exiting to $r_{rho} = .52$ During Evacuation. In the national samples, there were only a few exceptions for the PTS: in the Turkish (During Evacuation: $r_{rho} = .23$, $p > .05$; Upon Exiting: $r_{rho} = .23$, $p > .05$), UK (During Evacuation: $r_{rho} = .29$, $p > .05$) and Swedish (Upon Exiting: $r_{rho} = .26$, $p > .05$) samples the correlations were smaller and not significant. Furthermore, it was expected that the measure of panic-like symptoms and EDS at Realisation would be tapping into related constructs; the correlations, in the total sample ($r_{rho} = .60$, $p < .01$) as well as in all subsamples ($r_{rho} = .51-.74$), supported this.

Stage variations in emotion and cognition

The EDS was administered across four event stages, and a significant main effect was found, $\chi^2(3) = 636.52$, $p < .001$. Specifically, emotional distress significantly differed from one stage to the next (Beginning vs. Realisation: $Z = -23.51$, $p < .001$; Realisation vs. During Evacuation: $Z = -5.42$, $p < .001$; During Evacuation vs. Upon Exiting: $Z = -5.07$, $p < .001$), peaking at Realisation, then decreasing thereafter but always remaining above the level at the Beginning (see Figure 1). Perceived threat was measured at the latter three event stages and a main effect was revealed, $\chi^2(2) = 482.74$, $p < .001$, with significant differences located between Realisation and During Evacuation ($Z = -9.85$, $p < .001$) as well as between During Evacuation and Upon Exiting ($Z = -14.95$, $p < .001$). Like emotional distress, perceived threat peaked at Realisation and decreased thereafter. Perceived control, on the other hand, rose throughout the latter three event stages. A main effect was revealed, $\chi^2(2) = 60.12$, $p < .001$, with the significant difference located between Realisation and During Evacuation ($Z = -5.64$, $p < .001$). The apparent increase in perceived control between During Evacuation and Upon Exiting was not significant ($Z = -1.73$, $p = .083$).

Relationships between pre-, peri- and post-event variables

As mentioned earlier, some peri-event responses (emotional distress, perceived threat) were significantly associated with the measure of post-event stress, the IES-R.

Table 4. Initial activities with respect to the time taken to begin evacuating and injuries incurred.

Initial activities	Evacuation starting time						Injuries	
	≤30 s <i>N</i> (%)	≤2 min <i>N</i> (%)	≤5 min <i>N</i> (%)	≤10 min <i>N</i> (%)	≤30 min <i>N</i> (%)	>30 min <i>N</i> (%)	Yes <i>N</i> (%)	No <i>N</i> (%)
Nothing for a while	8(15.4)	25(16.9)	20(12.9)	23(17.3)	16(17.8)	16(12.6)	13(14.8)	143(15.7)
Alert/save others	15(28.8)	44(29.7)	42(27.1)	36(27.1)	23(25.6)	27(21.3)	25(28.4)	216(23.7)
Inform others	2(3.8)	5(3.4)	5(3.2)	5(3.8)	3(3.3)	6(4.7)	4(4.5)	41(4.5)
Sought help from emergency services	3(5.8)	15(10.1)	17(11.0)	19(14.3)	15(16.7)	5(3.9)	7(8.0)	103(11.3)
Sought shelter inside	0(0.0)	6(4.1)	6(3.9)	5(3.8)	4(4.4)	2(1.6)	6(6.8)	21(2.3)
Protect my property	1(1.9)	4(2.7)	7(4.5)	6(4.5)	4(4.4)	31(24.4)	3(3.4)	75(8.2)
Gave up	0(0.0)	2(1.4)	1(0.6)	6(4.5)	3(3.3)	2(1.6)	0(0.0)	17(1.9)
Gathered items	4(7.7)	17(11.5)	19(12.3)	13(9.8)	7(7.8)	21(16.5)	6(6.8)	85(9.3)
Sought information	6(11.5)	13(8.8)	16(10.3)	8(6.0)	5(5.6)	7(5.5)	0(0.0)	106(11.6)
Other	13(25.0)	17(11.5)	22(14.2)	12(9.0)	10(11.1)	10(7.9)	24(27.3)	104(11.4)

Table 5. Initial activities with respect to pre-event and other peri-event variables.

Initial activities	EKS		EDS		PTS		Panic		Control		Time pressure		Reaction	
	<i>M</i>	<i>SD</i>	<i>Yes N(%)</i>	<i>No N(%)</i>	<i>Automatic N(%)</i>	<i>Conscious N(%)</i>								
Nothing for a while	1.93	0.71	3.52	1.12	3.00	1.36	2.33	2.14	2.47	1.20	104(13.4)	53(22.3)	92(20.0)	63(11.6)
Alert/save others	2.40	0.89	3.14	1.04	2.77	1.22	1.62	1.71	3.23	1.13	210(27.1)	35(14.7)	116(25.2)	129(23.7)
Inform others	2.06	0.83	2.96	1.14	1.91	1.16	0.98	1.34	3.25	1.04	27(3.5)	18(7.6)	13(2.8)	33(6.1)
Sought help from emergency services	2.12	0.84	3.54	1.09	2.50	1.21	2.29	2.56	2.55	1.17	105(13.6)	9(3.8)	58(12.6)	54(9.9)
Sought shelter inside	2.38	1.03	3.75	1.13	3.46	1.40	2.85	2.51	3.11	1.05	22(2.8)	5(2.1)	13(2.8)	14(2.6)
Protect my property	2.14	0.78	3.10	1.15	2.18	1.15	1.58	1.92	3.03	1.09	66(8.5)	13(5.5)	38(8.2)	41(7.5)
Gave up	2.18	0.96	3.24	1.23	3.06	1.52	1.81	1.83	2.00	1.17	14(1.8)	3(1.3)	11(2.4)	6(1.1)
Gathered items	2.11	0.82	3.13	1.08	2.58	1.26	1.76	2.18	3.17	1.09	69(8.9)	23(9.7)	34(7.4)	58(10.7)
Sought information	2.50	0.92	2.84	1.12	2.19	1.11	1.14	1.82	3.38	1.13	61(7.9)	46(19.3)	28(6.1)	77(14.2)
Other	2.22	0.93	3.09	1.17	2.63	1.38	1.83	2.21	2.97	1.24	96(12.4)	33(13.9)	58(12.6)	69(12.7)

However, as Table 3 and further tests show, other peri-event variables were also significantly associated with the IES-R, namely panic-like symptoms, perceived control, time pressure ($Z = -8.53$, $p < .001$) and the type of initial reaction ($Z = -9.10$, $p < .001$). In other words, participants who, during the event, perceived themselves to experience more panic-like symptoms, be less in control, felt time-pressured and initially reacted in an automatic manner reported greater post-traumatic stress symptoms.

Tests revealed support for the other hypotheses too. Time to begin evacuating ($\chi^2[9] = 45.90$, $p < .001$) and injuries incurred ($\chi^2[9] = 38.22$, $p < .001$) were significantly related to participants' initial activities (see Table 4). However, time to begin evacuating was also significantly related to another peri-event variable, PTS at Realisation (i.e. the greater the threat perceived, the quicker participants were in starting their evacuation; see Table 3). Moreover, being injured was also significantly related to participants perceiving themselves to have experienced greater distress ($Z = -2.76$, $p < .01$) and threat ($Z = -4.18$, $p < .001$), more panic-like symptoms ($Z = -5.51$, $p < .001$) and less control ($Z = -3.45$, $p < .001$) at Realisation, plus if they felt time-pressured ($\chi^2[1] = 4.63$, $p < .05$) and reacted in an automatic way initially ($\chi^2[1] = 8.96$, $p < .01$). Finally, initial activities were revealed to be significantly related to the EKS ($\chi^2[9] = 43.95$, $p < .001$), EDS (Realisation: $\chi^2[9] = 42.43$, $p < .001$) and PTS (Realisation: $\chi^2[9] = 63.86$, $p < .001$). Panic-like symptoms ($\chi^2[9] = 57.37$, $p < .001$), perceived control ($\chi^2[9] = 78.89$, $p < .001$), time pressure ($\chi^2[9] = 68.89$, $p < .001$), as well as reacting either automatically or consciously ($\chi^2[9] = 40.07$, $p < .001$), were also significantly related to initial activities. Table 5 displays descriptive statistics relating to these variables and the initial activity undertaken by participants and shows that there was no one type of initial activity that was most related to all the different emotions and cognitions.

Discussion

This paper illustrates the content and psychometric properties of the BeSeCu-S, a comprehensive questionnaire for survivors. Project partners from eight different European countries elaborated the questionnaire specifically to learn more about human activities, emotions and cognition across cultures in relation to emergency situations. This process represents the first attempt to develop a standardised cross-cultural instrument for such interests. Survivors were not restricted to a specific incident (e.g. one particular fire or one particular flood), and therefore, this approach results in a more heterogeneous sample which increases the possibility of generalising findings with respect to different types of events (Briere and Elliott 2000).

Analyses confirmed that the questionnaire, on the whole, seemed to work as anticipated and captured what it was set out to capture. Scale analysis revealed one-factor solutions for the emergency knowledge, emotional distress and perceived threat scales, suggesting a unidimensionality of these scales. Internal consistency values (Cronbach's α) for the scales were satisfactory for the total sample since they were at least .7, which is considered the limit for acceptable scales (Gliem and Gliem 2003). These values were also confirmed in each national and incident subsample except for the two-item PTS. The PTS had poor internal consistency values in the UK and Spanish subsamples, and therefore, this scale cannot be considered reliable for these subsamples. Since these items refer to the perceived threat to oneself and one's family, the results might be due to specific terrorist incidents in the

UK and Spain. These events happened in the morning and mainly affected commuters. People commuting to and from work usually do not have friends or family around them and therefore should perceive no threat to them at the time of event. As a consequence, this scale might only be appropriate in other settings. Looking at the internal consistency values of the incident subsamples, this hypothesis is supported since these values are acceptable and good for domestic fires, floods and earthquakes but not for terrorist attacks and public building fires. Results of the confirmatory factor analysis suggest a very good fit in all indices for the EDS model. With respect to the other scale, CFI and IFI values were not satisfactory, whereas GFI and RMSEA values indicate at least an acceptable fit. Convergent and discriminant validity investigations suggest that the EDS especially can be considered valid in all national subsamples. The testing across different countries as well as different incidents largely supports our hypotheses (1) and (2) which stated that the BeSeCu-S would be suitable for international use as well as for capturing the experiences in different event types. Furthermore, emotional distress, perceived threat and perceived control significantly differed between the stages investigated, highlighting the dynamic, temporal aspects of survivor responses and supporting the additional suggestion that the BeSeCu-S would be suitable for capturing experiences across different stages of an event.

Hypothesis (3) was supported by significant relationships between the peri-event responses emotional distress and perceived threat with post-traumatic stress symptoms as measured by the IES-R. These relationships are in line with results from a meta-analysis concerning PTSD (Ozer et al. 2003). However, measures of panic-like symptoms, perceived control and sense of urgency were also significantly related to the IES-R suggesting researchers and clinicians should continue to consider a wide range of peri-event responses as being involved in the development of posttraumatic stress symptoms.

Significant relationships between initial activities and the time to begin evacuating, the experience of being injured, prior emergency knowledge plus emotional and cognitive peri-event responses were not only in line with hypotheses (4) and (5) but also in line with previously found interactions (Glenshaw et al. 2008; Zhao et al. 2009). However, analyses revealed additional relationships between these variables, for example, peri-event emotional or cognitive responses also being significantly related to how quickly survivors began moving away from the scene of danger and their success in avoiding physical harm. Any attempt to model causal relationships between pre-, peri- and post-event variables and to establish the relative size of their effects on one another is beyond the scope of this paper. Nevertheless, the data collected by the BeSeCu-S would allow for such attempts and more detailed analyses incorporating also possible effects of nationality, the type of incident and demographic factors will follow in subsequent papers (e.g. Knuth et al. 2013).

The BeSeCu-S employs a retrospective self-reporting approach. Despite employing survey and interview techniques during the development of the instrument, one could nevertheless question if it is possible to obtain the desired information by self-report. Previous research regarding the relationship between emotional distress and memory differs greatly with respect to the type of event (emotional vs. neutral), type of information required (central vs. peripheral), time since the event (immediate vs. delayed), role in the event (witness vs. victim), way in which emotion was induced (through sudden shocking sights vs. thematically) and the type of recall (cued vs.

free recall) (Bornstein, Liebel, and Scarberry 1998; Christianson 1992; Christianson and Loftus 1991; Hulse et al. 2007). Memories of disasters have been found to be very durable, even after two years (Stallings 2007, 66). Although there was great variation in the time elapsed since the event in the current study (up to 11 years ago), the mean number of years elapsed since the event was just over three years and should be reasonable for assessing peri-event psychological responses at least (Brunet et al. 2001). Furthermore, the non-significant or weak correlations between the number of weeks since the event and other variables in the current study would indicate that participants' memories of their responses were not distorted by the passage of time. Experimental studies have concluded that for emotionally arousing events involving shocking sights such as horrific injuries, central details seem to be remembered better, while peripheral information is remembered less well than in emotionally neutral events (Brown 2003; Christianson and Loftus 1991). A further study, which investigated the reliability of delayed self-reports regarding experiences in a hurricane (Norris and Kaniasty 1992), found that, in particular, reports of losses and preparedness remained stable when compared to the first reports made ten months earlier. A small tendency towards recalling more information was only found with respect to social support (Norris and Kaniasty 1992). To conclude then, it has been shown that survivors are quite able to remember aspects of a distressing event, even after a long period of time, although longitudinal studies covering longer periods of time are very rare. Nevertheless, it is important to note that some outcomes of an event (e.g. impacted life domains, support received or damage incurred) cannot be investigated immediately after the event.

The use of various sources for item generation is one of the strengths of the BeSeCu-S. Not only were actual survivors of different threatening events included, but also experts from the field of disaster and security research and, just as importantly, practitioners, who could include their needs for specific information. Practitioners were included at all stages of the development process to achieve an increased interaction with researchers as demanded by scholars (Fischer 2008). The different parts of the questionnaire (i.e. pre-, peri- and post-event) are a very distinctive and unique attribute of the BeSeCu-S which allows the researcher to get information in relation to different phases.

Limitations of the study

One limitation of the questionnaire might be the aim of its global usage. Although the questionnaire was designed with respect to five different event types, it might not be as applicable for one as for another. For flood incidents, the stages approach might be challenging. Since flooding is frequently caused and accompanied by heavy rain or bad weather conditions, it can be argued that the onset is therefore rather slow giving people more time to prepare and react. In addition, the duration of the incident itself can be much longer (days or weeks even) than for the other events. Questions regarding the exact date, time, start of evacuation and even emotional distress at the different event stages are more difficult to answer since each stage might take several days in itself. Additionally, the focus of this questionnaire concerned known threats to property as well as lives and therefore the process of leaving a specific structure. The BeSeCu-S might therefore be more appropriate for small-scale evacuations (e.g. of a single building or a few properties located close

together) rather than large-scale evacuations (e.g. of whole communities due to nuclear accidents or hurricanes).

Another issue is that the length of the BeSeCu-S is considerable, since completing it can take up to 40 min. Nevertheless, feedback regarding design and the subdivision of the BeSeCu-S into different stages was very positive, and people were glad to express some specifics not just once in an overall matter but for specified periods of time (i.e. stages) during the incident. However, it is unclear if this is also applicable for vulnerable groups such as older adults, children or people with cognitive impairments. It must be noted that a representative sample from all countries and regarding all incidents could not be obtained due to the fact that not all incidents occurred in each respective country. A potential self-selection bias needs to be taken into account as well. It is possible that survivors who participated in the study may represent a sub-group of individuals, and therefore, generalisability of findings is unknown. Survivors with severe traumatic experiences might have refused to participate to avoid reminders. Furthermore, it needs to be noted that non-response rates are not available for these data.

Conclusion and perspectives

BeSeCu-S is a questionnaire for threatening events and enables the comparison of survivor responses (emotions, cognitions, activities) across different event types, stages of an event and cultures. How stressful is a fire in a public building compared with a domestic fire? Answering questions like this is very difficult since different methodological approaches have been used over the past years. The BeSeCu-S can help advance understanding for researchers and practitioners alike.

Acknowledgements

The project BeSeCu (contract No.218324) is funded under the European Union Framework programme 7 – Security. The authors acknowledge the collaboration of their project partners: Ernst-Moritz-Arndt University of Greifswald, Germany; Hamburg Fire and Emergency Service Academy, Germany; University of Greenwich, UK; Institute of Public Security of Catalonia, Spain; Prague Psychiatric Centre, Czech Republic; MTO Säkerhet AB (MTO Safety AB), Sweden; Main School of Fire Service, Poland; Association of Emergency Ambulance Physicians, Turkey; University of Bologna, Italy; in undertaking this work and in allowing the project findings to be published.

References

- American Psychiatric Association. 2000. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: American Psychiatric Association.
- Bauer, P. J., M. M. Burch, S. E. Scholin, and O. E. Güler. 2007. “Using Cue Words to Investigate the Distribution of Autobiographical Memories in Childhood.” *Psychological Science* 18 (10): 910–916. doi: 10.1111/j.1467-9280.2007.01999.x.
- Bergh Johannesson, K., S. Stefanini, T. Lundin, and R. Anchisi. 2006. “Impact of Bereavement Among Relatives in Italy and Sweden after the Linate Airplane Disaster.” *International Journal of Disaster Medicine* 4 (3): 110–117. doi: 10.1080/15031430600969034.
- Bornstein, B. H., L. M. Liebel, and N. C. Scarberry. 1998. “Repeated Testing in Eyewitness Memory: A Means to Improve Recall of a Negative Emotional Event.” *Applied Cognitive Psychology* 12 (2): 119–131. doi: 10.1002/(SICI)1099-0720(199804)12:2<119::AID-ACP500>3.0.CO;2-4.
- Briere, J., and D. Elliott. 2000. “Prevalence, Characteristics, and Long-term Sequelae of Natural Disaster Exposure in the General Population.” *Journal of Traumatic Stress* 13 (4): 661–679. doi: 10.1023/A:1007814301369.

- Brown, J. M. 2003. "Eyewitness Memory for Arousing Events: Putting Things into Context." *Applied Cognitive Psychology* 17 (1): 93–106. doi: 10.1002/Acp.848.
- Brunet, A., D. S. Weiss, T. J. Metzler, S. R. Best, T. C. Neylan, C. Rogers, J. Fagan, and C. R. Marmar. 2001. "The Peritraumatic Distress Inventory: A Proposed Measure of PTSD Criterion A2." *The American Journal of Psychiatry* 158 (9): 1480–1485.
- Christianson, S.-A. 1992. "Emotional Stress and Eyewitness Memory: A Critical Review." *Psychological Bulletin* 112 (2): 284–309. doi: 10.1037//0033-2909.112.2.284.
- Christianson, S.-A., and E. F. Loftus. 1991. "Remembering Emotional Events: The Fate of Detailed Information." *Cognition & Emotion* 5 (2): 81–108. doi: 10.1080/02699939108411027.
- Collins, D. 2003. "Pretesting Survey Instruments: An Overview of Cognitive Methods." *Quality of Life Research* 12 (3): 229–238. doi: 10.1023/A:1023254226592.
- Corapcioglu, A., İ. Yargıç, P. Geyran, and N. Kocabaşoğlu. 2006. "Validity and Reliability of Turkish Version of "Impact of Event Scale-Revised" (IES-R)." *Yeni Symposium* 44 (1): 14–22. Accessed from [http://www.yenisymposium.net/fulltext/2006\(1\)/ys2006_44_1_2.pdf](http://www.yenisymposium.net/fulltext/2006(1)/ys2006_44_1_2.pdf).
- Cordón, I. M., M.-E. Pipe, L. Sayfan, A. Melinder, and G. S. Goodman. 2004. "Memory for Traumatic Experiences in Early Childhood." *Developmental Review* 24 (1): 101–132. doi: 10.1016/j.dr.2003.09.003.
- Eremenco, S. L., D. Cella, and B. J. Arnold. 2005. "A Comprehensive Method for the Translation and Cross-cultural Validation of Health Status Questionnaires." *Evaluation the Health Professions* 28 (2): 212–232. doi: 10.1177/0163278705275342.
- Field, A. P. 2009. *Discovering Statistics Using SPSS: (And Sex and Drugs and Rock 'n' Roll)*. 3rd ed. London: Sage.
- Fischer, H. W. 2008. *Response to Disaster. Fact Versus Fiction and its Perpetuation. The Sociology of Disaster*, Vol. 3. Lanham, MA: University Press of America.
- Fothergill, A., E. G. Maestas, and J. D. Darlington. 1999. "Race, Ethnicity and Disasters in the United States: A Review of the Literature." *Disasters* 23 (2): 156–173. doi: 10.1111/1467-7717.00111.
- Freitag, S., A. Grimm, and S. Schmidt. 2011. "Talking about Traumatic Events: A Cross-cultural Investigation." *Europe's Journal of Psychology* 7 (1): 40–61. doi: 10.5964/ejop.v7i1.104.
- Galea, E. R. 2009. *Evacuation Response Phase Behaviour (no. 09/IM/147)*. London: CMS Press.
- Gargurevich, R., P. Luyten, J.-F. Fils, and J. Corveleyn. 2009. "Factor Structure of the Impact of Event Scale-revised in Two Different Peruvian Samples." *Depression and Anxiety* 26 (8): E91–E98. doi: 10.1002/da.20430.
- GfK GeoMarketing. 2008. Europa bleibt gespalten. GfK Kaufkraft für 41 europäische Länder [Europe Remains Divided. GfK Purchasing Power Survey of 41 Countries in Europe]. Accessed August 3, 2010. http://www.gfk.com/imperia/md/content/presse/pm_kaufkraft_europa_2008_dfin.pdf.
- Glenshaw, M. T., J. S. Vernick, S. Frattaroli, S. Brown, and S. Mallonee. 2008. "Injury Perceptions of Bombing Survivors – Interviews from the Oklahoma City Bombing." *Pre-hospital and Disaster Medicine* 23 (6): 500–506.
- Gliem, J., and R. Gliem. 2003. "Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales." *Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education*, 82–88. Columbus, Ohio OR – The Ohio State University.
- Grimm, A., L. Hulse, M. Preiss, and S. Schmidt. In press. Behavioural, Emotional and Cognitive Responses in European Disasters: Results of Survivor Interviews. *Disasters* 38 (1).
- Grimm, A., L. Hulse, and S. Schmidt. 2012. "Human Responses to Disasters: A Pilot Study on Peritraumatic Emotional and Cognitive Processing." *Europe's Journal of Psychology* 8 (1): 112–138. doi: 10.5964/ejop.v8i1.303.
- Guha-Sapir, D., F. Vos, R. Below, and S. Ponserre. 2011. *Annual Disaster Statistical Review 2010: The Numbers and Trends*. Brussels: CRED.
- Hilton, A., and M. Skrutkowski. 2002. "Translating Instruments into Other Languages: Development and Testing Processes." *Cancer Nursing* 25 (1): 1–7. doi: 10.1097/00002820-200202000-00001.

- Horowitz, M., N. Wilner, and W. Alvarez. 1979. "Impact of Event Scale – A Measure of Subjective Stress." *Psychosomatic Medicine* 41 (3): 209–218. <Go to ISI>://A1979HB61200004.
- Hu, L., and P. M. Bentler. 1999. "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives." *Structural Equation Modeling* 6 (1): 1–55. doi: 10.1080/10705519909540118.
- Hulse, L., K. Allan, A. Memon, and J. D. Read. 2007. "Emotional Arousal and Memory: A Test of the Poststimulus Processing Hypothesis." *The American Journal of Psychology* 120 (1): 73–90.
- Juczyński, Z., and N. Ogińska-Bulik. 2009. "Measurement of Post-traumatic Stress Disorder – Polish Version of Impact of Event Scale-revised." *Psychiatria* 6 (1): 15–25.
- Kasapoglu, A., and E. Mehmet. 2004. "Comparative Behavioral Response to Future Earthquakes: The Cases of Turkey and USA." *Social Behavior and Personality* 32 (4): 373–382. doi: 10.2224/sbp.2004.32.4.373.
- Kaysen, D., M. K. Morris, S. L. Rizvi, and P. A. Resick. 2005. "Peritraumatic Responses and their Relationship to Perceptions of Threat in Female Crime Victims." *Violence Against Women* 11 (12): 1515–1535. doi: 10.1177/1077801205280931.
- Knuth, D., D. Kehl, L. Hulse, and S. Schmidt. 2013. "Perievent Distress During Fires – The Impact of Perceived Emergency Knowledge." *Journal of Environmental Psychology* 34: 10–17. doi: <http://dx.doi.org/10.1016/j.jenvp.2012.12.002>.
- Knuth, D., D. Kehl, and S. Schmidt. 2013. "Development of Field Study Instruments BeSeCu-S and BeSeCu-FR." In *Behaviour-Security-Culture. Human Behaviour in Emergencies and Disasters: A Cross-cultural Investigation*, edited by S. Schmidt and E. Galea. Lengerich: Papst Science.
- Knuth, D., D. Kehl, K. Stegemann, and S. Schmidt. 2013. "Recruitment Strategies Across all Centers." In *Behaviour-Security-Culture. Human Behaviour in Emergencies and Disasters: A Cross-cultural Investigation*, edited by S. Schmidt and E. Galea. Lengerich: Papst Science.
- Kobes, M., and K. Groenewegen. 2009. *Consumer Fire Safety: European Statistics and Potential Fire Safety Measures*. Vienna: Austrian Federal Ministry Labor, Social Affairs and Consumer Protection (Vol. 31).
- Kobes, M., I. Helsloot, B. de Vries, and J. G. Post. 2010. "Building Safety and Human Behaviour in Fire: A Literature Review." *Fire Safety Journal* 45 (1): 1–11. doi: 10.1016/j.firesaf.2009.08.005.
- Lahad, M., and S. Crimando. 2010. Preparing for the Next Generation of Disasters. *Journal of Jewish Communal Service*, 85(2/3): 320–330. http://www.xbrm.com/wp-content/uploads/2010/11/JJCS_Preparing...Disasters_SummerFall-2010.pdf.
- Lindell, M. K., and R. W. Perry. 2011. "The Protective Action Decision Model: Theoretical Modifications and Additional Evidence." *Risk Analysis* 32 (4): 616–632. doi: 10.1111/j.1539-6924.2011.01647.x.
- Maercker, A., and M. Schützwohl. 1998. "Erfassung von psychischen Belastungsfolgen: Die IES-R -revidierte Version [Assessing Effects of Traumatic Events: The Impact of Event Scale-Revised]." *Diagnostica* 44: 130–141.
- Marmar, C. R., D. S. Weiss, and T. J. Metzler. 1996. "The Peritraumatic Dissociative Experiences Questionnaire." In *Assessing Psychological Trauma and PTSD*, edited by J. P. Wilson and T. M. Keane, 144–167. New York: The Guilford Press.
- McConnell, N. C., K. E. Boyce, and T. J. Shields. 2009. "An Analysis of the Recognition and Response Behaviours of Evacuees of WTC 1 on 9/11." *Proceedings 4th International Human Behaviour in Fire Symposium*, 659–670. London: Interscience Communications.
- McConnell, N. C., K. E. Boyce, T. J. Shields, E. R. Galea, R. C. Day, and L. Hulse. 2010. "The UK 9/11 Evacuation Study: Analysis of Survivors' Recognition and Response Phase in WTC1." *Fire Safety Journal* 45 (1): 21–34. doi: 10.1016/j.firesaf.2009.09.001.
- Meyers, L. S., G. Gamst, and A. J. Guarino. 2006. *Applied Multivariate Research: Design and Interpretation*. Thousand Oaks, CA: Sage.
- Norris, F. H., and K. Kaniasty. 1992. "Reliability of Delayed Self-reports in Disaster Research." *Journal of Traumatic Stress* 5 (4): 575–588. doi: 10.1002/jts.2490050407.

- Ozer, E. J., S. R. Best, T. L. Lipsey, and D. S. Weiss. 2003. "Predictors of Posttraumatic Stress Disorder and Symptoms in Adults: A Meta-analysis." *Psychological Bulletin* 129 (1): 52–73. doi: 10.1037/0033-2909.129.1.52.
- Petersen, C., S. Schmidt, M. Power, and M. Bullinger. 2005. "Development and Pilot-testing of a Health-related Quality of Life Chronic Generic Module for Children and Adolescents with Chronic Health Conditions: A European Perspective." *Quality of Life Research* 14 (4): 1065–1077. doi: 10.1007/s11136-004-2575-z.
- Pielmaier, L., and A. Maercker. 2011. "Psychological Adaptation to Lifethreatening Injury in Dyads: The Role of Dysfunctional Disclosure of Trauma." *Psychotraumatology* 2: 8749–8761. doi: 10.3402/ejpt.v2i0.8749.
- Pillemer, D. B. 1998. "What is Remembered about Early Childhood Events?" *Clinical Psychology Review* 18 (8): 895–913. doi: [http://dx.doi.org/10.1016/S0272-7358\(98\)00042-7](http://dx.doi.org/10.1016/S0272-7358(98)00042-7).
- Preiss, M., P. Mohr, M. Kopeček, V. Melanová, V. Janečka, M. Rodriguez, and T. Hájek. 2004. "Trauma a Stress osm měsíců po povodních v roce 2002 [Trauma and Stress Eight Months After Floods in 2002]." *Psychiatrie* 8 (3): 180–186. doi: RIV/00023752:_____/04:00000426.
- Proulx, G., and I. M. A. Reid. 2006. "Occupant Behavior and Evacuation During the Chicago Cook County Administration Building Fire." *Journal of Fire Protection Engineering* 16 (4): 283–309. doi: 10.1177/1042391506065951.
- Rodríguez, H., E. L. Quarantelli, and R. Dynes. 2006. *Handbook of Disaster Research*. New York: Springer.
- Rubin, D. C. 2000. "The Distribution of Early Childhood Memories." *Memory* 8 (4): 265–269. doi: 10.1080/096582100406810.
- Samochine, D. A., K. E. Boyce, and T. J. Shields. 2005. "An Investigation into Staff Behaviour in Unannounced Evacuations of Retail Stores – Implications for Training and Fire Safety Engineering." In *Fire Safety Science*, Vol. 8, edited by I. A. for F. S. Science, 519–530. London: IAFSS Symposium 810.3801/IAFSS.FSS.8-519.
- Schenk, L., A.-M. Bau, T. Borde, J. Butler, T. Lampert, H. Neuhauser, O. Razum, and C. Weilandt. 2006. "Mindestindikatorensatz zur Erfassung des Migrationsstatus" [A Basic set of Indicators for Mapping Migrant Status. Recommendations for Epidemiological Practice]." *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz* 49 (9): 853–860. doi: 10.1007/s00103-006-0018-4.
- Stallings, R. A. 2007. "Methodological Issues." In *Handbook of Disaster Research*, edited by H. Rodríguez, E. L. Quarantelli, and R. Dynes, 56–82. New York: Springer Science +Business Media.
- Weiss, D. S., and C. R. Marmar. 1997. "The Impact of Event Scale – Revised." In *Assessing Psychological Trauma and PTSD*, edited by J. P. Wilson and T. M. Keane, 399–411. New York: Guilford.
- Zhao, C. M., S. M. Lo, S. P. Zhang, and M. Liu. 2009. "A Post-fire Survey on the Pre-evacuation Human Behavior." *Fire Technology* 45 (1): 71–95. doi: 10.1007/s10694-007-0040-6.

Anhang B: Studie 2

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (*in press*). Risk perception, experience and objective risk: A cross-national study with European emergency survivors. *Risk Analysis*. doi: 10.1111/risa.12157

Risk Perception, Experience, and Objective Risk: A Cross-National Study with European Emergency Survivors

Daniela Knuth,^{1,*} Doris Kehl,¹ Lynn Hulse,² and Silke Schmidt¹

Understanding public risk perceptions and their underlying processes is important in order to learn more about the way people interpret and respond to hazardous emergency events. Direct experience with an involuntary hazard has been found to heighten the perceived risk of experiencing the same hazard and its consequences in the future, but it remains unclear if cross-over effects are possible (i.e., experience with one hazard influencing perceived risk for other hazards also). Furthermore, the impact of objective risk and country of residence on perceived risk is not well understood. As part of the BeSeCu (Behavior, Security, and Culture) Project, a sample of 1,045 survivors of emergencies from seven European countries (i.e., Germany, the Czech Republic, Poland, Sweden, Spain, Turkey, and Italy) was drawn. Results revealed heightened perceived risk for emergency events (i.e., domestic and public fires, earthquakes, floods, and terrorist attacks) when the event had been experienced previously plus some evidence of cross-over effects, although these effects were not so strong. The largest country differences in perceived risk were observed for earthquakes, but this effect was significantly reduced by taking into account the objective earthquake risk. For fires, floods, terrorist attacks, and traffic accidents, only small country differences in perceived risk were found. Further studies including a larger number of countries are welcomed.

KEY WORDS: Hazard experience; objective risk; risk perception

1. INTRODUCTION

Emergency events such as building fires, terrorist bombings, floods, and earthquakes are hazards that pose a threat to lives and property. Insurers and public-sector professionals concerned with safety and security will be interested in the actual occurrence of such events in their own geographic regions and the harm/damage incurred consequently. How-

ever, they will also be interested in the “objective risk” calculated from this, that is, the likelihood of these events and their negative consequences occurring to the average person, in order to better inform their work and protect the public. Yet the public’s own perception of the risk connected to such events might also, in part, influence how well they are protected. Risk perception as a psychological construct is defined as a subjective judgment made by people when characterizing and evaluating hazards.^(1,2) Perceived risk, in turn, may be defined as the perceived likelihood of personally encountering a hazard⁽³⁾ and the possibility of incurring negative consequences. Several studies have investigated a relationship between risk perception and preparedness and some have revealed that the greater the perceived risk associated with an emergency event, the better prepared people were for experiencing that event; that

¹Department Health and Prevention, Institute of Psychology, Ernst-Moritz-Arndt-University of Greifswald, Greifswald, Germany.

²Fire Safety Engineering Group, Department of Mathematical Sciences, University of Greenwich, London, UK.

*Address correspondence to Daniela Knuth, Department Health and Prevention, Institute of Psychology, Ernst-Moritz-Arndt-University of Greifswald, Robert-Blum-Str. 13, 17487 Greifswald, Germany; tel: +49 (0)3834 86-3808; fax: +49 (0)3834 86-3801; daniela.knuth@uni-greifswald.de.

is, with a flood they were more likely to raise heating, ventilation, and electrical systems above flood level and add waterproof veneer to exterior walls;⁽⁴⁾ plan their own escape in the event of a domestic fire and practice this plan;⁽⁵⁾ and in the case of a terrorist attack, establish an emergency plan, have an emergency supply kit to hand, and learn about public evacuation plans.⁽⁶⁾ Although a direct positive relationship between perceived risk and emergency preparedness actions has been questioned,⁽⁷⁾ and has not been found for all emergency events that threaten lives and property (see, e.g., Tekeli-Yesil *et al.*'s study involving earthquakes⁽⁴⁾), risk perception is still one factor (among others) that can increase the likelihood for the adoption of mitigation measures⁽⁷⁾ and therefore help lessen the chances of suffering severe injury or property damage in an emergency.

How are public risk perceptions formed? The social amplification of risk framework (SARF)⁽⁸⁾ states that psychological, social, and cultural processes interact with hazard events, and this can either increase or decrease perceived risk and, in turn, influence behavior regarding these events. The SARF further emphasizes the importance of both direct personal experience with an event and indirect exposure through information about the event.⁽⁸⁾ In this regard, the availability heuristic⁽⁹⁾ might also be important in that people's probability estimations may be mediated by the possibility to recall events and similar cases in one's own environment.⁽⁹⁾ Thus, for an emergency event, people's risk perceptions will likely be influenced by their own personal experience with that type of hazard. However, it is not clear whether this experience would also affect risk perceptions for other hazards. If this were true, it is possible that direct exposure to one emergency event might help prepare the public more widely for emergencies than first thought. It is also feasible that information about the objective risk, provided by insurers, emergency services' safety campaigns, health and safety notices, and so forth, might have an influence, as well as media stories. This study investigated the impact of hazard experience and objective risk on risk perception in a sample of European survivors of the following emergency events: a fire (in their home or a public building), a flood, an earthquake, or a terrorist attack. Recognizing that the survivor data were nested within countries sampled, this study conducted multilevel modeling. This allowed analysis of the effect of hazard experience (at the individual level) on risk perception plus the effect of

objective risk (calculated based on geographic region and therefore a variable at the group, i.e., country level). It further allowed for cultural aspects to be considered.

1.1. Hazard Experience

Previous, direct experience with a hazard has been found to influence risk perception.^(10–18) For instance, Ho *et al.*⁽¹²⁾ compared risk perception for different types of hazardous event (i.e., earthquakes, floods, landslides, fires, environmental pollution, and contagious diseases) and found that, of the six events, floods and landslides were rated as most risky when participants had personally experienced such events. Furthermore, they found that the frequency of disaster experience was positively associated with the perceived likelihood of those disasters occurring again and the perceived threat to the participants' lives.⁽¹²⁾ Other researchers who have looked at a single type of event have demonstrated that direct experience with that event (usually a natural hazard like a flood,^(14,17) a hurricane,⁽¹⁹⁾ an earthquake,^(13,20) and also bushfires⁽²¹⁾) can result in heightened perceived risk for that hazard. SARF theory proposes that heightened perceived risk arises because personal experience with events leads to those events being more memorable and easier to imagine.⁽⁸⁾ However, other factors might also influence the effect of experience on risk perception. For example, a positive effect might only result if the hazard is considered "involuntary," that is, an event that people would not normally choose to experience. Barnett and Breakwell⁽¹⁰⁾ found a positive relationship between the frequency of directly experiencing an involuntary hazard (e.g., being in a hurricane, being in a motorway pileup) and concern about the risk the event poses. In contrast, the relationship was negative when the events were voluntary hazards (e.g., skiing, smoking). A recent review⁽²²⁾ that concluded that experience with natural disasters leads to an elevation of risk in most cases would be in line with this. As this study was interested in what could be considered involuntary, memorable events, the following hypothesis was derived:

- (1) Experience with a particular hazard will lead to elevated perceived risk for this hazard.

If experienced hazards are indeed more easily pictured in one's mind then should not other, similar forms of hazard also be easier to picture?

Consequently, should not risk perception for other types of events also be influenced by hazard experience? From prior research the answer remains unclear. For example, one investigation, of residents' perception of a coastal flood risk,⁽¹⁴⁾ revealed higher perceived risk when participants had previously experienced floods but not when participants had experienced a storm surge. Also, in a study on the optimistic bias (i.e., the tendency to believe that the risk of experiencing a negative event is lower for one's self than for other people), Helweg-Larsen⁽¹¹⁾ found no evidence of this bias in a sample of earthquake survivors when the event was an earthquake but did find an optimistic bias for other events like fires and floods. Results like these would suggest that hazard experience only affects risk perception for the particular type of event experienced. On the other hand, other research⁽¹⁵⁾ has demonstrated that flood experience may not only be positively correlated with perceived risk for floods but also with risk for hurricanes and chemical hazards. Thus, it might be premature to make such a conclusion.

It is probably too simplistic to assume different hazards will be pictured and evaluated in a similar fashion because they may all be labeled as "negative" or "emergency events/disasters." It may be that experience makes specific aspects of an event more marked in people's minds and it is those aspects that people consider when evaluating other hazards, although it is not clear what those aspects might be. The research examples above would argue against it being the physical or sensory aspects (e.g., floods and storm surges both involve raised water levels yet were not perceived in the same way;⁽¹⁴⁾ also, floods, hurricanes, and chemical hazards are very different in this respect yet risk perceptions for all were affected⁽¹⁵⁾). It is also unlikely to be the type and scale of the harm as the aforementioned events all posed the risk of serious injury/death, and to many as opposed to just a single occupant. Perhaps it is not so much a question of being able to picture certain aspects of the event but being able to picture one's self in the given context. Self-relevance is an issue in risk research as the questions often do not ask participants either explicitly or solely about the risk to themselves/their lives, which might prevent or dilute attempts to recall related incidents/information and imagine going through such an experience. In this study, the risk perception question was more clearly worded in this respect. Therefore, the following second hypothesis was investigated:

- (2) Experience with a particular hazard will affect perceived risk for at least some other hazards (i.e., *cross-over effect*).

1.2. Objective Risk

Public risk perceptions have been compared to objective risk estimations based on hazard occurrence statistics⁽²³⁾ or expert judgments.⁽¹⁴⁾ The results have been inconsistent but, in general, perceived risk for a given event has tended not to perfectly match the objective risk for that event.⁽²³⁻²⁷⁾ Nonetheless, this does not mean there is no relationship between perceived and objective risk. For example, positive correlations between perceived and objective risk estimations have been found for floods,^(14,17,28) different causes of death,⁽²³⁾ and problems like unemployment, inflation, and crime.⁽²⁹⁾ It would stand to reason that if events occur less frequently, and would therefore be objectively rated as lower risk, this could also then lead to lower perceived risk: less frequent occurrences would mean that not only would an individual be less likely to directly experience the event, but so would other reference points (e.g., family, friends, colleagues). There would also likely be less indirect exposure from other sources too (e.g., information from emergency services, governments) as they would not view such events as a priority. Thus, rare events would be less available, less easy to picture, and therefore perceived as posing less risk. Of course, other sources of information, specifically the media, might behave differently with regards to rare events, lending disproportionate attention to such occurrences when they did happen.⁽⁸⁾ However, it might be expected that governments and other protection agencies would react to this by releasing information about the objective risk to reassure the public that the incident was not a common event. Research⁽³⁰⁾ has hinted that people's risk perceptions can be manipulated by helping raise their awareness of the (low) incidence of a hazardous event. Swedish participants were first encouraged to think about the 2004 tsunami—an event with which they had no direct experience—then engaged in an ease-of-thought generation task before rating perceived risk for different life events (e.g., having a heart attack before the age of 50, not finding a job, marrying someone wealthy, receiving job recognition). When the generation task was harder (i.e., participants were asked to list a further six natural disasters that had occurred), their perceptions of risk regarding the life events were

less pessimistic than when the generation task was easy (i.e., list just two disasters). In fact, their risk perceptions were more in line with a control group who had not been encouraged to think about any natural disaster, including the tsunami. The authors concluded that the difficult generation task had made participants aware of the low probability of natural disasters and thus counteracted the negative effect induced by thinking about the original type of disaster (the tsunami).⁽³⁰⁾ In this study, the relationship between objective and perceived risk was tested directly, the third hypothesis being:

- (3) Objective risk will influence risk perception.

1.3. Cultural and Personal Characteristics

Nationality and cultural factors also appear to be influential.^(3,31) People from countries such as Spain, Turkey, and the United Kingdom have been found to display a constantly above average concern for the risk terrorism poses to their nation.⁽³²⁾ These country effects are believed to relate to the long-term history these countries have with terrorist attacks.⁽³²⁾ Furthermore, in a study comparing the risk perception of participants from Sweden, Spain, the United Kingdom, and France,⁽³³⁾ results indicated country differences in the perceived risk (to oneself and others combined) posed by hazards such as nuclear power; Swedish participants' risk ratings were lowest, followed by ratings from the United Kingdom, then Spain, and finally France. It seemed that trust played a part in some of the variation, although was not a strong determinant. Moreover, a comparison between participants from Turkey and Norway,⁽³⁴⁾ this time in relation to road traffic hazards, similarly revealed country differences in risk perception, which were related to attitudes and behavior when participants were from Norway but not from Turkey.

This study sampled widely, across several countries. It was not clear from previous research exactly where or why national differences might be expected, nor what effect country of residence might have on perceived risk to one's self as opposed to others/the general public. Nevertheless, the following fourth hypothesis was tested:

- (4) Perceived risk will differ between countries.

Finally, in addition to country of residence, other sociodemographic or personal characteristics have

been reported to affect risk perception, for example, higher perceived risk when participants are of female gender,^(12,14,15,35,36) older age,^(14,36) married,⁽³⁷⁾ or a lower level of education,^(14,36) although it is questionable whether such factors have a strong effect.⁽³⁷⁾ Personal characteristics were taken into account in the current study also.

2. METHOD

2.1. Sample

As part of the E.U.-funded BeSeCu (Behavior, Security, and Culture) Project a sample was drawn of 1,112 citizens who had survived a fire in a domestic or public setting, an earthquake, a terrorist attack, or a flood in one of the European countries where project partners were based (i.e., Germany, the Czech Republic, Poland, Sweden, Spain, Turkey, the United Kingdom, and Italy). All participants gave their informed consent and met the following inclusion criteria: (1) at least 18 years of age; (2) the emergency services attended the incident; and (3) the emergency did not happen any earlier than 1999. Participants' data were obtained through a self-report instrument (BeSeCu-S), which was the result of a cross-national development process⁽³⁸⁾ including literature review, expert consultations, focus groups with survivors and first responders, and a pretest. Participants who did not provide data for all of the risk perception items ($n = 31$) or their country of residence ($n = 3$) were excluded from this study. Furthermore, people were eliminated if they currently lived in a country that was not one of the aforementioned European countries ($n = 5$). The sample of U.K. participants had to be eliminated as well because this sample was too small for further analysis ($n = 28$). The final sample comprised 1,045 participants (94.0% of the total sample). There were no differences concerning gender ($\chi^2(1) = 1.60, p = 0.206$), relationship status ($\chi^2(1) = 0.23, p = 0.629$), education level ($\chi^2(2) = 0.10, p = 0.949$), or age ($F(1,1069) = 0.18, p = 0.674$).

2.2. Risk Perception and Hazard Experience

Participants were asked: *In your opinion, how likely is it that, in the future, you will become a victim of the following emergency situations?* The situations covered the five different types of emergency event participants had survived as well as a traffic accident, the latter allowing for cross-national comparisons

of a commonly high-frequency emergency event. Perceived risk for each event was assessed on a scale from 0% to 100%.

Experience with one of the five emergency events of main interest was a main inclusion criterion for all BeSeCu Project participants, but they were asked further about prior emergency experiences: *Before the incident occurred, had you ever experienced any of the following incidents? Please tick all that apply.* (Answer options were: *a fire in a home; a fire in a public building; an earthquake; a terrorist attack; a flood*). Hazard experience was then coded for each event as Yes versus No.

2.3. Objective Risk

Country-specific objective risk in this article was based on available hazard occurrence data, which are displayed in Table I. For each country, the number of events that occurred during a specific time period was multiplied by 100 and then divided by the mean population⁽³⁹⁾ of the country during this time period. For terrorist attacks, earthquakes, and floods this number was divided by the number of years in the respective time period in order to get the one-year risk. The resulting one-year risk was then multiplied by the mean life expectancy of the country,⁽⁴⁰⁾ which resulted in the corresponding lifetime risk (see Table II). Note, for earthquakes, floods, and terrorist attacks, the objective risk was calculated using the data on being affected or injured by the event rather than the number of events in the time period.

2.4. Personal Characteristics

Sociodemographic characteristics were recorded and coded as follows: Gender (Male vs. Female), Age (in years), Relationship (Yes vs. No), and Education (Low (1) vs. Medium (2) vs. High (3)). In addition to general education, participants' education related specifically to emergencies was assessed with the Emergency Knowledge Scale (EKS), which contained the following question: *Before the incident occurred, what knowledge did you have that would be of use in an emergency?* Seven different statements were assessed on a five-point Likert scale ranging from 1 (*not at all*) to 5 (*extreme*): *I had professional knowledge, gained from working for the emergency services; I had first aid knowledge, gained from a first aid course; I had fire safety knowledge, gained from being a warden/fire safety officer; I had taken part in fire drills at school; I*

had taken part in fire drills at work; I had read safety notices/evacuation plans in public places, such as in hotel rooms, train carriages, etc.; and I had thought about what would happen if an emergency occurred in such a location and had prepared my own evacuation plan. Responses to the seven statements were aggregated and the mean score was used in analyses.

3. DATA ANALYSIS

The particular method of multilevel analysis used was restricted maximum likelihood (REML) estimation as it provides reasonable⁽⁴¹⁾ variance estimates if a small number of groups is used.⁽⁴²⁾ The required number of groups for multilevel analysis is a contentious issue. Several researchers have put forward rules of thumb for a minimum number yet these differ wildly, for example, 20 groups for every 30 individuals, 30 groups for the same number of individuals, 50 groups for 20 individuals, 100 groups for 10 individuals. While the authors of this article agree that the more groups (and individuals per group; not an issue here) the better, we also agree with statisticians such as Gelman,⁽⁴³⁾ who argues that while conducting multilevel modeling with a smaller number of groups may not be ideal, it may be optimal when the alternative is "classical" regression modeling, which does not acknowledge the nested nature of the data and may produce results that are less easy to interpret.

A series of six analyses were run, the dependent variable being perceived risk for, in turn, a domestic fire, a public fire, a terrorist attack, a flood, an earthquake, and a traffic accident. For each analysis a step-wise approach was used, starting with the intercept-only model, which included just the dependent variable and country factor but no predictors (model 0). The constant for fixed effects represents the mean value of intercepts and the constant for random effects refers to the variance of the country level. In the subsequent model, individual-level predictors were included (model 1). In the final model (model 2), the country-level predictor objective risk (for the same event as the dependent variable) was added. Since experience with a traffic accident was not assessed in this study (see Table IV), only the impact of other experiences on perceived traffic risk (i.e., cross-over effects) was investigated for that case. In all models the predictors age, education, emergency knowledge, and objective risk were

Table I. Number of Different Incidents Across Years and Countries

	Czech Republic	Germany	Italy	Poland	Sweden	Spain	Turkey
Fires (2004) ⁽⁴⁶⁾	20,550	179,272	212,837	161,720	24,620	–	60,801
Terrorist attacks (1990–2010) ⁽⁴⁷⁾	17	554	205	32	45	966	1,925
Being injured	27	466	124	36	26	1,610	3,057
Earthquakes (1900–2012) ⁽⁴⁸⁾	0	2	32	1	0	3	76
Affected	0	1,675	1,054,521	1,050	0	15,390	6,924,005
Floods (1900–2012) ⁽⁴⁸⁾	12	14	37	13	2	26	38
Affected	322,332	536,758	2,865,312	368,574	–	749,160	177,8520
Traffic accidents (2008)	22,481 ⁽⁴⁹⁾	320,614 ⁽⁴⁹⁾	218,963 ⁽⁴⁹⁾	49,054 ⁽⁴⁹⁾	18,462 ⁽⁴⁹⁾	93,161 ⁽⁴⁹⁾	950,120 ⁽⁵⁰⁾

Table II. Country-Specific Objective Risk (in% of the Mean Population) for Different Events

	Czech Republic	Germany	Italy	Poland	Sweden	Spain	Turkey
Fires	15.50	17.35	29.77	31.98	22.14	–	6.55
Terrorist attacks	0.00063	0.00270	0.00144	0.00032	0.00204	0.00940	0.01093
Injured	0.00101	0.00228	0.00087	0.00035	0.00118	0.01566	0.01736
Earthquakes	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Affected	0.00	0.00	1.33	0.00	0.00	0.03	7.02
Floods	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Affected	2.15	0.47	3.60	0.65	–	1.30	1.80
Traffic accidents	16.60	31.18	29.78	9.72	16.20	16.44	96.93

Table III. Sociodemographic Characteristics of the Sample ($N = 1,045$)

	Gender (%)		Relationship (%)		Education (%)			Age	
	Male	Female	No	Yes	Low	Medium	High	<i>M</i>	<i>SD</i>
Czech Republic ($n = 166$)	30.7	69.3	37.3	62.7	13.9	20.5	65.7	44.11	17.13
Germany ($n = 202$)	43.6	56.4	29.4	70.6	10.0	29.0	61.0	41.11	15.61
Italy ($n = 169$)	42.3	57.7	30.4	69.6	2.4	7.8	89.8	32.57	13.58
Poland ($n = 184$)	46.7	53.3	28.4	71.6	4.4	1.1	94.5	39.43	12.79
Spain ($n = 103$)	49.5	50.5	28.2	71.8	17.5	12.6	69.9	44.45	12.11
Sweden ($n = 81$)	42.0	58.0	45.0	55.0	20.0	5.0	75.0	47.12	19.79
Turkey ($n = 140$)	64.4	35.6	31.4	68.6	12.9	9.4	77.7	37.47	11.67
$\chi^2(df)/F(df1,df2)$	36.34*** (6)		11.06 (6)		127.12*** (12)			14.93*** (6,1029)	
Cramers's <i>V</i> ; η	.19		.10		.25			.28	

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

centered on their grand mean in order to facilitate the interpretation of the corresponding coefficients. The fit of the two models was compared with the likelihood ratio test and the amount of variance at the country level was calculated using the intraclass correlation (ICC). The ICC can “be defined as the proportion of the variance in the outcome that is between the groups or higher level units.”⁽⁴⁴⁾ Analysis of variance (ANOVA) and χ^2 tests, as well as their corresponding effect sizes Cramers's *V* and η , were calculated using SPSS to test differences between countries. Multilevel analyses were conducted using STATA 11.0.

4. RESULTS

4.1. Sample and Descriptive Results

Sociodemographic characteristics are presented in Table III, while Table IV displays the hazard experience of this sample by country of residence. In total, the type of event experienced most often by participants was a domestic fire, with terrorist attacks experienced least. However, there were some differences in hazard experience across countries, for example, markedly more experience with terrorism in Spain (30.1%) than in other countries (0.5–5.8%).

Table IV. Amount of Participants with Experience of Each Type of Hazard ($N = 1,045$)

	Total		Czech Republic		Germany		Italy		Poland		Spain		Sweden		Turkey	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Domestic fires	622	59.8	95	57.2	140	69.7	55	33.1	126	68.5	51	49.5	75	92.6	80	57.6
Public fires	220	21.2	30	18.1	39	19.3	24	14.5	32	17.5	39	37.9	22	27.2	34	24.5
Terrorist attacks	50	4.8	3	1.8	4	2.0	2	1.2	1	0.5	31	30.1	1	1.2	8	5.8
Floods	264	25.4	103	62.0	55	27.4	25	15.1	50	27.3	10	9.7	4	4.9	17	12.3
Earthquakes	223	21.4	2	1.2	18	9.0	120	71.0	3	1.6	9	8.7	1	1.2	70	50.7

Table V. Country-Level Characteristics Concerning Emergency Knowledge and Perceived Risk

	Emergency Knowledge		Domestic Fire PR		Public Fire PR		Terror PR		Flood PR		Earthquake PR		Traffic PR	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total	2.20	0.87	32.88	28.37	26.70	25.89	15.96	23.44	25.97	28.93	21.41	28.87	52.79	29.84
Czech Republic	2.00	0.69	32.73	27.63	26.77	26.75	15.78	24.61	37.92	31.11	11.82	21.70	58.31	28.34
Germany	2.43	0.84	29.87	28.63	22.39	24.50	14.15	22.04	19.58	27.86	7.90	14.85	51.40	30.64
Italy	1.93	0.69	25.75	21.76	25.14	20.00	12.95	15.86	22.71	21.28	43.79	27.16	52.39	26.48
Poland	2.09	0.84	38.17	30.34	26.46	28.02	8.16	16.09	27.97	32.71	7.09	15.88	51.75	31.24
Spain	2.13	0.89	28.38	27.94	26.85	26.19	24.87	26.58	19.19	22.73	13.53	20.37	47.82	28.09
Sweden	2.47	0.92	27.85	27.36	25.11	25.53	9.71	18.90	9.36	14.76	4.75	9.86	38.87	30.02
Turkey	2.56	1.14	46.31	29.40	37.42	28.56	32.19	31.74	38.03	31.58	61.43	28.50	61.96	30.00

Note. PR = perceived risk.

The amount of prior emergency knowledge in this sample could be considered small or at best moderate ($M = 2.20, SD = 0.87$) with a range of $M = 1.93$ ($SD = 0.69$) in Italy to $M = 2.56$ in Turkey ($SD = 1.14$). Internal reliability in the present sample was good (Cronbach's $\alpha = 0.81$). Perceived risk, irrespective of type of event, was always highest for people in Turkey and usually rather low for participants in Sweden (see Table V).

4.2. Intercept-Only Models

The intercept-only models (model 0) revealed a statistically significant amount of variation in perceived risk due to the country of residence (see Table VI). The amount of variance between the seven countries (ICC) ranged from 3% in public fire perceived risk to about 53% of the total variation in earthquake perceived risk. The variation at the individual level (residual) was much greater than the variation at the country level (constant) for all risks except for earthquakes.

4.3. Random-Intercept Models

The first model of each analysis (model 1) only included the individual-level variables. The results in

Tables VII and VIII demonstrate higher perceived risk for all events when participants were female. A negative relationship between age and perceived risk as well as a positive relationship between emergency knowledge and perceived risk was found for all events. Education had an impact on perceived risk for domestic fires, terrorist attacks, floods, and earthquakes, with less-educated participants assigning higher perceived risk values in these cases. For all events, hazard experience was an important predictor for perceived risk. Experience with a particular event increased perceived risk for that event, although it had only a minor impact on perceived risk for other events.

Compared to model 1, model 2—which now included the country-level variable objective risk—produced a significantly better model fit for perceived risk concerning terrorist attacks ($\chi^2(1) = 6.66, p < 0.01$), floods ($\chi^2(1) = 4.72, p < 0.05$), and earthquakes ($\chi^2(1) = 13.86, p < 0.001$). Models 1 and 2 for perceived risk concerning traffic accidents ($\chi^2(1) = -1.58, p = 1.00$), domestic fires ($\chi^2(1) = 0.53, p = 0.469$), and public fires ($\chi^2(1) = -0.17, p = 1.000$) did not differ significantly from one another. Compared to the intercept-only models there was a significant reduction in country-level variance now for

Table VI. Results of Multilevel Analyses Predicting Perceived Risk for Different Hazards (Random Intercept-Only Model)

Fixed effects	Domestic Fire PR	Public Fire PR	Terror PR	Flood PR	Earthquake PR	Traffic PR
	Model 0 Coeff. (z)	Model 0 Coeff. (z)				
Constant	33.47 (10.80) ^{***}	27.14 (12.93) ^{***}	16.80 (5.16) ^{***}	27.56 (7.85) ^{***}	21.48 (2.58) [*]	51.98 (19.40) ^{***}
Random effects	Var. (SE)	Var. (SE)				
Constant	52.17 (36.65) ^{***}	21.70 (17.03) ^{***}	70.25 (43.04) ^{***}	68.51 (47.08) ^{***}	483.53 (281.12) ^{***}	43.86 (30.32) ^{***}
Residual	766.65 (35.84)	653.29 (30.85)	497.34 (22.37)	809.71 (37.73)	437.09 (19.57)	862.25 (38.25)
ICC	0.06	0.03	0.12	0.08	0.53	0.05

Note. ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$; Domestic and Public Fire PR calculations do not include Spain and Flood PR calculations do not include Sweden because no objective risk could be calculated in those instances.

Table VII. Results of Multilevel Analyses Predicting Perceived Risk for Domestic and Public Fires and Terrorist Attacks (Models 1 and 2)

Fixed effects	Domestic Fire PR		Public Fire PR		Terror PR	
	Model 1 Coeff. (z)	Model 2 Coeff. (z)	Model 1 Coeff. (z)	Model 2 Coeff. (z)	Model 1 Coeff. (z)	Model 2 Coeff. (z)
Constant	23.93 (5.36) ^{***}	23.84 (5.16) ^{***}	16.99 (5.05) ^{***}	16.99 (5.01) ^{***}	10.66 (2.95) ^{**}	10.01 (3.67) ^{**}
Gender (Male = ref.)	5.65 (2.96) ^{**}	5.68 (2.97) ^{**}	5.69 (3.24) ^{**}	5.69 (3.25) ^{**}	6.16 (4.17) ^{***}	6.21 (4.21) ^{***}
Age	-0.23 (-3.61) ^{***}	-0.23 (-3.61) ^{***}	-0.31 (-5.30) ^{***}	-0.32 (-5.31) ^{***}	-0.10 (-2.06) ^{**}	-0.11 (-2.17) [*]
Education	-6.57 (-4.06) ^{***}	-6.52 (-4.03) ^{***}	-2.93 (-1.95)	-2.81 (-1.87)	-4.03 (-3.27) ^{**}	-4.00 (-3.26) ^{**}
Relationship (No = ref.)	4.25 (2.16) [*]	4.27 (2.17) [*]	4.40 (2.45) [*]	4.45 (2.47) [*]	-0.99 (-0.66)	-0.94 (-0.62)
Emergency knowledge	3.69 (3.18) ^{**}	3.66 (3.14) ^{**}	3.44 (3.24) ^{**}	3.37 (3.16) ^{**}	3.97 (4.44) ^{***}	3.88 (4.35) ^{***}
Domestic fire exp.	8.25 (3.52) ^{***}	8.24 (3.51) ^{***}	3.65 (1.70)	3.61 (1.68)	1.28 (0.73)	1.29 (0.73)
Public fire exp.	2.48 (0.97)	2.45 (0.95)	11.08 (4.69) ^{***}	11.01 (4.65) ^{***}	6.05 (3.09) ^{**}	5.78 (2.95) ^{**}
Flood exp.	-4.62 (-1.87)	-4.65 (-1.88)	-2.47 (-1.09)	-2.53 (-1.12)	0.20 (0.10)	0.68 (0.36)
Terror exp.	10.76 (1.59)	10.62 (1.57)	10.99 (1.79)	10.72 (1.74)	19.32 (5.36) ^{***}	17.83 (4.98) ^{***}
Earthquake exp.	-4.09 (-1.36)	-4.16 (-1.38)	0.23 (0.09)	0.15 (0.05)	-0.11 (-0.05)	0.46 (0.21)
Objective risk		-0.29 (-0.71)		-0.22 (-0.95)		852.76 (3.72) ^{***}
Random effects	Var. (SE)					
Constant	61.26 (43.25) ^{***}	69.41 (53.86) ^{***}	18.44 (14.96) ^{***}	19.43 (17.04) ^{***}	52.06 (33.26) ^{***}	12.72 (11.81) ^{**}
Residual	721.19 (34.78)	721.16 (34.78)	598.19 (29.06)	598.12 (29.06)	465.97 (21.47)	466.14 (21.49)
ICC	0.08	0.09	0.03	0.03	0.10	0.03

Note ^{*} $p < 0.05$, ^{**} $p < 0.01$, ^{***} $p < 0.001$; Domestic and Public Fire PR calculations do not include Spain, since the objective risk could not be calculated

all models. Objective risk not only explained a great amount of country-level variance concerning perceived risk for terrorist attacks and earthquakes but it was also a significant predictor that was positively associated with perceived risk for these events. The greatest amount of country-level variance (88%) was explained by model 2 for earthquake perceived risk. The ICC decreased from 0.53 in model 0 to 0.12 in model 2. Concerning terrorist attack perceived risk, 78% of country-level variance was explained by model 2. Almost a quarter of the country-level variance for traffic accident perceived risk (24%) was explained by model 2. For domestic fire perceived risk an increase in country-level variance was detected (from model 0 to model 1). Perceived risk concerning public fires and floods was reduced by including

the individual-level variables (model 1) but not by including the objective risk (model 2). The amount of explained variance at the individual level also varied across perceived risk for the different events (i.e., 3% for domestic fires, 6% for traffic accidents, 9% for public fires, 16% for terrorist attacks, 21% for floods, and 51% for earthquakes in model 2).

5. DISCUSSION AND LIMITATIONS

This study investigated the impact of hazard experience, objective risk, and country of residence on perceived risk for different emergency events. Hypothesis (1) stated there would be a positive relationship between hazard experience and the perceived risk of the experienced hazard. The results

Table VIII. Results of Multilevel Analyses Predicting Perceived Risk for Floods, Earthquakes, and Traffic Accidents (Models 1 and 2)

	Flood PR		Earthquake PR		Traffic PR	
	Model 1 Coeff. (z)	Model 2 Coeff. (z)	Model 1 Coeff. (z)	Model 2 Coeff. (z)	Model 1 Coeff. (z)	Model 2 Coeff. (z)
Fixed effects						
Constant	20.87 (4.81)***	20.82 (4.59)***	13.19 (1.81)	12.97 (3.68)***	44.34 (11.57)***	44.36 (11.74)***
Gender (Male = ref.)	4.76 (2.69)**	4.79 (2.70)**	6.07 (4.47)***	6.09 (4.48)***	4.48 (2.31)*	4.59 (2.37)*
Age	-0.29 (-4.55)***	-0.28 (-4.52)***	-0.19 (-3.99)***	-0.19 (-4.04)***	-0.35 (-5.30)***	-0.35 (-5.25)***
Education	-6.64 (-4.43)***	-6.64 (-4.44)***	-3.33 (-2.94)**	-3.30 (-2.91)**	-2.28 (-1.42)	-2.21 (-1.38)
Relationship (No = ref.)	1.20 (0.66)	1.20 (0.65)	0.71 (0.51)	0.76 (0.55)	2.87 (1.44)	2.87 (1.44)
Emergency knowledge	3.80 (3.49)***	3.82 (3.50)***	3.12 (3.78)***	3.04 (3.68)***	2.81 (2.40)*	2.73 (2.32)*
Domestic fire exp.	-4.66 (-2.26)*	-4.61 (-2.24)*	0.80 (0.49)	0.68 (0.42)	0.72 (0.31)	0.77 (0.33)
Public fire exp.	-0.07 (-0.03)	-0.04 (-0.02)	0.94 (0.52)	0.89 (0.49)	6.05 (2.36)*	6.06 (2.37)*
Flood exp.	28.47 (12.84)***	28.49 (12.84)***	2.42 (1.36)	2.42 (1.37)	2.51 (1.01)	2.70 (1.08)
Terror exp.	0.86 (0.20)	0.99 (0.23)	3.35 (1.00)	3.30 (0.99)	10.63 (2.26)*	10.72 (2.28)*
Earthquake exp.	-5.48 (-2.07)*	-5.80 (-2.16)*	15.31 (7.15)***	15.57 (7.32)***	3.18 (1.08)	2.54 (0.85)
Objective risk		2.24 (0.63)		6.54 (5.48)***		0.11 (1.22)
Random effects	Var. (SE)					
Constant	65.91 (45.55)***	76.20 (57.91)***	338.39 (198.48)***	53.75 (36.69)***	34.92 (25.57)***	32.06 (25.93)***
Residual	617.18 (29.51)	617.16 (29.51)	395.54 (18.23)	395.55 (18.23)	820.61 (37.48)	820.57 (37.48)
ICC	0.10	0.11	0.46	0.12	0.04	0.04

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Flood PR does not include Sweden, since the objective risk could not be calculated.

support this hypothesis since experience with a particular hazard was one of the most important predictors of perceived risk of that same hazard and its influence was in a positive direction. The greatest impact was found for flood experience on perceived risk of a flood, followed by earthquake experience on perceived risk of an earthquake, which suggests that experience is especially important regarding events that are less universal. These results are in line with previous results concerning the impact of experience on perceived risk of floods^(14,17) and earthquakes.⁽¹³⁾ Increased perceived risk with experience may be explained by the availability heuristic⁽⁹⁾ and SARF theory; it is proposed that people assess the ease with which events can be recalled when making judgments about risk. If recalling an event is easy, which is likely to be the case for people who have experienced an emergency, that event will be perceived as being more likely to occur and posing greater consequences than events that are more difficult to bring to mind.⁽⁹⁾ While the emotional and impactful nature of emergencies might make recalling past experiences easier, a recency effect would also facilitate recall. As mentioned above, the relationship between hazard experience and perceived risk was strongest for floods and earthquakes. In the current sample, flood survivors mainly experienced their events in the Czech Republic, Germany, and Poland, while the greatest por-

tion of earthquake survivors came from Turkey and Italy. Looking at the past occurrences of earthquakes in Italy and Turkey, it can be noted that about half of the past events in these countries since 1900 happened within the last 30 years (i.e., 43.8% for Italy and 48.7% for Turkey). For floods, the recency of the events is even stronger (i.e., 91.7% for the Czech Republic, 85.7% for Germany, and 61.5% for Poland). Therefore, these hazards may still be topics of conversation among family and community members, keeping the events rehearsed in their minds. Moreover, there may still be visual reminders in the physical/built environment, for example, damaged buildings or infrastructure awaiting restoration. This might explain the relatively greater impact of experience of these hazards on perceived risk.

Hypothesis (2) stated that hazard experience would affect perceived risk for at least some other hazards and was also supported to a certain extent as some cross-over effects were found. Experience with a public fire not only increased perceived risk of a public fire but also perceived risk of a terrorist attack. Similarly, experience with a public fire and a terrorist attack increased perceived risk of a traffic accident. It is possible that the cross-over effects for the latter might have diminished if experience of traffic accidents had been included as well. However, there was clearly something in the

participants' experiences with public fires and terrorist attacks that bore relation to their perceptions of traffic accidents. In all the aforementioned cross-over effects, the events have context in common. Terrorist attacks, public fires, and traffic accidents would in almost all circumstances occur in a public setting. Thus, if a person had experienced an emergency before in a building (or outdoor space) that was not so familiar, surrounded by lots of people who also might not have been so familiar, with a place of safety and comfort some distance away, he or she might have been able to easily picture himself or herself, the threat, and the person's ability to cope in those circumstances again when imagining the context of the nonexperienced events. The effect might have been aided by explicitly asking participants about their own likelihood of becoming a victim of these events. This theory is supported by the additional finding of a negative relationship between experience with both domestic fires and earthquakes and perceived risk of floods. Again, these three events share a (private setting this time) context. Assuming the consequences of the fire and earthquake experiences were not too severe, it is likely that participants remained in the same home afterwards but took steps to protect family/property in the future (e.g., planned escape routes, secured fixtures) and therefore may have perceived less risk from a flood. While this theory may explain the findings reported here, it is not clear whether it could explain the presence or lack of cross-over effects reported in previous research.^(14,15) Further investigation is needed and should attempt to disentangle the issue of self-relevance and give greater focus to contextual factors.

Of course, if the above theory was the primary explanation for the results described above from the current study, significant reciprocal cross-over effects would be expected also (e.g., of terrorist attack experience on perceived risk of a public fire, flood experience on perceived risk of a domestic fire/earthquake, etc.), which was not the case here. One possible issue that might have complicated matters is the way in which perceived risk was operationalized in this study. Becoming a victim might mean something different for people with experience than for people without. The word *victim* might have been interpreted as *getting killed* by many people without experience whereas many of those with experience might have interpreted it as meaning *being affected* because their last exposure to an emergency event had obviously not killed them. Being more ambiguous, *being affected* could have brought to

mind different things for different people in different contexts.

The results of the final models (model 2) allow comment on Hypothesis (3), which stated that objective risk would influence risk perception. The greatest impact of objective risk on perceived risk was found for earthquakes and for terrorist attacks. For the latter, the high perceived risk values of participants in Turkey and Spain were in line with the objective risk for terrorist attacks, which was highest for people in Turkey and Spain. This result indicates that people might have some awareness of the objective risk and this awareness could inform risk perception. As stated earlier, awareness might arise from (the lack of) hazard experience (their own and possibly that of family, friends, colleagues) and/or exposure to information about the objective risk. Previous reports of a positive relationship between objective and perceived flood risk were not confirmed by this study as the impact of objective risk did not reach statistical significance. Though the model including objective flood risk was statistically different from the model without objective risk, the results demonstrated an increase rather than a decrease in country-level variance. One possible explanation for the lack of a significant correlation between objective flood risk and perceived risk of a flood might be the operationalization of objective risk. A positive relationship between objective and perceived flood risk was found in previous studies whenever the objective flood risk was more geographically specific; that is, regions were divided into specific low- and high-risk areas^(14,17) or flood plain maps were utilized.⁽²⁸⁾ The use of a global objective flood risk for an entire country might not always be appropriate to reveal the impact of objective risk estimations.

Hypothesis (4) stated there would be differences in perceived risk between the countries and was supported by the findings. Perceived risk for all events was significantly influenced by country of residence although the extent of the influence differed across events. The greatest variation between countries was found for perceived risk of an earthquake followed by perceived risk of a terrorist attack and perceived risk of a flood. Half of the total variance in perceived risk of an earthquake could be accounted for by country of residence. Country differences concerning traffic accidents, fires, and floods can be considered as rather small, since less than 10% of the total variance was due to the country factor.⁽⁴⁵⁾ Descriptive results support these findings. Concerning perceived risk of an earthquake, the values assigned

by participants in Turkey and Italy were much larger compared to participants in the other countries. In general, participants from Turkey scored very high across all perceived risks, which is line with previous results.^(13,34) The fact that, as discussed earlier, Turkey is no stranger to experiencing earthquakes and the finding of cross-over effects with other emergencies affecting private settings might partly explain this. In addition, Turkey's road safety record might have played a part. Elevated perceived risk of traffic accidents in Turkey has previously been related to a less safe traffic system as well as problems in road and vehicle quality,⁽³⁴⁾ which is supported by the very high numbers of traffic accidents in this study. Higher perceived risk of a terrorist attack for participants in Spain and Turkey is also in line with previous findings,⁽³²⁾ and likely connected to these countries' histories of terrorism conducted by separatist groups. However, the results of model 2 need to be taken into consideration because country-level variances were significantly reduced when objective risk was incorporated. Although the country-level variation remained significant for all hazards after this, the variation in perceived risk of a terrorist attack and an earthquake was substantially reduced from 12% to 3% and from 53% to only 12% of the total variance, respectively. This implies that the effect of factors connected to country of residence beyond the frequency with which the country experiences an event (e.g., cultural attitudes) may be quite small. However, objective risk had no significant impact on perceived risk of fires (domestic and public), floods, or traffic accidents, nor did it decrease country-level variance. For example, with the exception of Turkey, perceived risk of domestic and public fires was very similar across countries even though objective risks differed. It may be that the majority of such events are not considered sensational enough by journalists/broadcasters (perhaps due to relatively less visible destruction than seen with, say, an earthquake or bombing), thus these events receive little nationwide attention by the media and consequently there is less need for governments and other agencies to publicize objective risk information as a counteraction, the result being lower awareness of the objective risk.

In addition to hazard experience and objective risk, significant effects were observed in the final models of female gender (positive), age (negative), education (negative), and prior emergency knowledge (positive) on perceived risk. These effects were observed for all events, with the exception of public fires and traffic accidents when the variable was

education. The influence of sociodemographic characteristics on risk perception has been raised before in past research but with questions over whether they explain much variance in perceived risk.⁽³¹⁾ This study looked at education further by including a measure of how well educated participants perceived themselves to be with regards specifically to emergencies. The greater the perceived knowledge concerning topics like first aid and participation in fire drills, the higher the perceived risk concerning all emergency events. A study with survivors of floods and landslides found no significant relationship between knowledge of mitigation actions and perceived risk to one's own life when the event was a flood and a negative significant relationship when it was a landslide.⁽¹²⁾ The relationship between knowledge and perceived risk was positive, and significant, for both events when the risk question asked about whether the event would be likely to occur in the survivors' community. These mixed results highlight the need to be clear about what is meant by perceived risk. Furthermore, the study⁽¹²⁾ only included a single question on knowledge and that was related to mitigation actions for floods/landslides. This study's measure comprised several items on knowledge that would be relevant to other emergency events as well as the one in question with the results showing that this knowledge impacted perceived risk for all six events in a rather global manner.

No study is without limitation and, therefore, some important issues need to be considered. As stated earlier, some researchers have questioned the use of multilevel analysis when there is only a small number of groups. In this study there were seven groups (countries). Hox⁽⁴¹⁾ states that if the number of groups is around 10, the variance estimates are too small. Thus, it might be possible that country-level variance is underestimated in this study. Nevertheless, the findings here still demonstrate that country-level variance in perceived risk might be substantially reduced if objective risk data are considered. With respect to objective risks in this study, attempts were made to collect such data for each type of event from a single source. However, this was not always possible, for example, with the country-specific occurrence data for traffic accidents, and so the collection of these data might therefore differ between the countries. The possibility of objective risk information having been collected differently in each country might mean an over- or underestimation of any observed impact of objective risk. Unfortunately, differences in the reporting of the occurrence of, and

outcomes from, hazards is a problem that has existed for some time. However, as countries forge closer political ties and more standardized regulations and practices, this may pose less of a challenge to international research in the future. Another issue is that the country samples might not be representative, which limits the generalizability of these findings. Furthermore, a crucial selection bias might be present since it is possible that people with an especially high level of perceived risk took part in the BeSeCu Project in order to support research regarding emergency events. If one perceives a very high likelihood of becoming a victim again in the future, one might want to take an active role to enhance knowledge regarding these incidents. If, on the other hand, someone has experienced an event but still evaluates the future risk as very low, one might not be as motivated to participate, since there is no obvious future benefit in doing so.

In conclusion, this article shows that experience with a hazard elevates perceived risk for that hazard and potentially for some other hazards also. Furthermore, it reveals an effect of country of residence on perceived risk; an effect that greatly depends on the hazardous event investigated and that might diminish if country-specific objective risk is taken into consideration. Future studies should attempt to replicate these findings with a broader range of countries and look further into why experience of one type of event might have a cross-over effect on perceived risk for certain other types of event (e.g., shared context, specific type of consequences, etc.). Finally, this article reveals that emergency knowledge, gained in a variety of ways (i.e., not just through professional training but through school, work, notices, autodidacticism) can have a wide-ranging elevating effect on perceived risk.

ACKNOWLEDGMENTS

The article was written by the authors on behalf of the BeSeCu group. The project BeSeCu (contract no. 218324) is funded under the European Union Framework Programme 7—Security. The authors acknowledge the collaboration of their project partners: Ernst-Moritz-Arndt University of Greifswald, Germany (Silke Schmidt—project coordinator, Daniela Knuth, Doris Kehl); Hamburg Fire and Emergency Service Academy, Germany (Frank Seidler and Eberhard Diebe); University of Greenwich, United Kingdom (Ed Galea and Lynn Hulse); Institute of Public Security of Cat-

alonia, Spain (Jordi Sans, Malin Roiha and Lola Valles); Prague Psychiatric Centre, the Czech Republic (Marek Preiss, Marie Sotolarova, and Marketa Holubova); MTO Säkerhet AB (MTO Safety AB), Sweden (Lena Kecklund, Sara Petterson, and Kristin Andréé); Main School of Fire Service, Poland (Jerzy Wolanin and Grzegorz Beltowski); Association of Emergency Ambulance Physicians, Turkey (Zeynep Baskaya Sofuoglu and Turhan Sofuoglu); and University of Bologna, Italy (Luca Pietrantonio and Elisa Saccinto) in undertaking this work and in allowing the project findings to be published.

REFERENCES

1. Slovic P. Perception of risk. *Science*, 1987; 236(4799):280–285.
2. Slovic P. Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield. *Risk Analysis*, 1999; 19(4):689–701.
3. Gierlach E, Bradley EB, Beutler LE. Cross-cultural differences in risk perceptions of disasters. *Risk Analysis*, 2010; 30(10):1539–1549.
4. Tekeli-Yesil S, Dedeoglu N, Braun-Fahrlaender, Tanner M. Factors motivating individuals to take precautionary action for an expected earthquake in Istanbul. *Risk Analysis*, 2010; 30(8):1181–1195.
5. Yang J, Peek-Asa C, Allareddy V, Zwerling C, Lundell J. Perceived risk of home fire and escape plans in rural households. *American Journal of Preventive Medicine*, 2006; 30(1):7–12.
6. Lee JEC, Lemyre L. A social-cognitive perspective of terrorism risk perception and individual response in Canada. *Risk Analysis*, 2009; 29(9):1265–1280.
7. Bubeck P, Botzen WJW, Aerts JCJH. A review of risk perceptions and other factors that influence flood mitigation behavior. *Risk Analysis*, 2012; 32(9):1481–1495.
8. Kasperson RE, Renn O, Slovic P, Brown HS, Emel J, Goble R, Kasperson JX, Ratick S. The social amplification of risk: A conceptual framework. *Risk Analysis*, 1988; 8(2):177–187.
9. Tversky A, Kahneman D. Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 1973; 5(2):207–232.
10. Barnett J, Breakwell GM. Risk perception and experience: Hazard personality profiles of individual differences. *Risk Analysis*, 2001; 21(1):171–178.
11. Helweg-Larsen M. (The lack of) optimistic biases in response to the 1994 Northridge earthquake: The role of personal experience. *Basic and Applied Social Psychology*, 1999; 21(2):119–129.
12. Ho M-C, Shaw D, Lin S, Chiu Y-C. How do disaster characteristics influence risk perception? *Risk Analysis*, 2008; 28(3):635–643.
13. Kasapoglu A, Mehmet E. Comparative behavioral response to future earthquakes: The cases of Turkey and USA. *Social Behavior and Personality*, 2004; 32(4):373–382.
14. Kellens W, Zaalberg R, Neutens T, Vanneuville W, Maeyer PD. An analysis of the public perception of flood risk on the Belgian coast. *Risk Analysis*, 2011; 31(7):1055–1068.
15. Lindell MK, Hwang SN. Households' perceived personal risk and responses in a multihazard environment. *Risk Analysis*, 2008; 28(2):539–556.
16. Plapp T, Werner U. Understanding risk perception from natural hazards: Examples from Germany. Pp. 101–108 in Aman W, Dananenmann S, Vulliet L (eds). *RISK21—Coping*

- with Risks Due to Natural Hazards in the 21st Century. Monte Verità, Switzerland: Taylor & Francis, 2004.
17. Siegrist M, Gutscher H. Flooding risks: A comparison of lay people's perceptions and expert's assessments in Switzerland. *Risk Analysis*, 2006; 26(4):971–979.
 18. Terpstra T. Emotions, trust, and perceived risk: Affective and cognitive routes to flood preparedness behavior. *Risk Analysis*, 2011; 31(10):1658–1675.
 19. Viscusi WK, Zeckhauser RJ. National survey evidence on disasters and relief: Risk beliefs, self-interest, and compassion. *Journal of Risk and Uncertainty*, 2006; 33(1–2):13–36.
 20. Kung Y-W, Chen S-H. Perception of earthquake risk in Taiwan: Effects of gender and past earthquake experience. *Risk Analysis*, 2012; 32(9):1535–1546.
 21. Gow K, Pritchard F, Chant D. How close do you have to be to learn the lesson? Fire burns! *Australian Journal of Disaster and Trauma Studies*, 2008; 2:1–19.
 22. Wachinger G, Renn O, Begg C, Kuhlicke C. The risk perception paradox—Implications for governance and communication of natural hazards. *Risk Analysis*, 2013; 33(6):1049–1065.
 23. Lichtenstein S, Slovic P, Fischhoff B, Layman M, Combs B. Judged frequency of lethal events. *Journal of Experimental Psychology*, 1978; 4(6):551–578.
 24. Hakes JK, Viscusi WK. Dead reckoning: Demographic determinants of the accuracy of mortality risk perceptions. *Risk Analysis*, 2004; 24(3):651–664.
 25. Sjöberg L. Risk perception by the public and by experts: A dilemma in risk management. *Human Ecology Review*, 1999; 6(2):1–8.
 26. Sjöberg L. Factors in risk perception. *Risk Analysis*, 2000; 20(1):1–11.
 27. Slovic P, Fischhoff B, Lichtenstein S. Facts and fears: Understanding perceived risk. Pp. 181–217 in Schwing RC, Albers WA, Jr. (trans & eds). *Societal Risk Assessment. How Safe Is Safe Enough?* New York: Plenum Press, 1980.
 28. Horney JA, MacDonald PD, Willigen MV, Berke PR, Kaufman JS. Individual actual or perceived property flood risk: Did it predict evacuation from Hurricane Isabel in North Carolina, 2003? *Risk Analysis*, 2010; 30(3):501–511.
 29. Loewenstein G, Mather J. Dynamic processes in risk perception. *Journal of Risk and Uncertainty*, 1990; 3(2):155–175.
 30. Vastfjäll D, Peters E, Slovic P. Affect, risk perception and future optimism after the tsunami disaster. *Judgment and Decision Making Journal*, 2008; 3(1):64–72.
 31. Bontempo RN, Bottom WP, Weber EU. Cross-cultural differences in risk perception: A model-based approach. *Risk Analysis*, 1997; 17(4):479–488.
 32. Drakos K, Müller K. On the Determinants of Terrorism Risk Concern in Europe. Berlin: Economics of Security.
 33. Viklund MJ. Trust and risk perception in western Europe: A cross-national study. *Risk Analysis*, 2003; 23(4):727–738.
 34. Şimşekoğlu Ö, Nordfjærn T, Rundmo T. Traffic risk perception, road safety attitudes, and behaviors among road users: A comparison of Turkey and Norway. *Journal of Risk Research*, 2012; 15(7):787–800.
 35. Andersson H. Perception of own death risk: An assessment of road-traffic mortality risk. *Risk Analysis*, 2011; 31(7):1069–1082.
 36. Armas I. Earthquake risk perception in Bucharest, Romania. *Risk Analysis*, 2006; 26(5):1223–1234.
 37. Eisenman DP, Glik D, Ong M, Zhou Q, Tseng C-H, Long A, Fielding J, Asch S. Terrorism-related fear and avoidance behavior in a multiethnic urban population. *American Journal of Public Health*, 2009; 99(1):168–174.
 38. Knuth D, Kehl D, Galea E, Hulse L, Sans J, Valles L, Roiha M, Seidler F, Diebe E, Kecklund L, Petterson S, Wolanin J, Beltowski G, Preiss M, Sotolarova M, Holubova M, Sofuoglu T, Baskaya Z, Pietrantonio L, Saccinto E, Schmidt S. BeSeCuS—A self-report instrument for emergency survivors. *Journal of Risk Research*, 2013. doi: 10.1080/13669877.2013.815649.
 39. WHO Regional Office for Europe. European health for all database. Copenhagen, Denmark. Accessed November 7, 2012.
 40. U.N. Department of Economic and Social Affairs. *World Population Prospects: The 2010 Revision*. CD ROM edition. New York: U.N. Department of Economic and Social Affairs.
 41. Hox JJ. *Multilevel Analysis: Techniques and Applications*, 2nd ed. New York: Routledge, 2010. (Quantitative Methodology Series.)
 42. Browne WJ, Draper D. Implementation and performance issues in the Bayesian and likelihood fitting of multilevel models. *Computational Statistics*, 2000; 15(3):391–420.
 43. Gelman A, Hill J. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. New York: Cambridge University Press, 2007.
 44. Diez Roux AV. A glossary for multilevel analysis. *Journal of Epidemiology & Community Health*, 2002; 56(8):954–954.
 45. Lee VE. Using hierarchical linear modeling to study social contexts: The case of school effects. *Educational Psychologist*, 2000; 35(2):125–141.
 46. Brushlinsky NN, Hall JR, Sokolov SV, Wagner P. World fire statistics. Centre of Fire Statistics Report No. 13.
 47. National Consortium for the Study of Terrorism and Responses to Terrorism. *The Global Terrorism Database 2011*, cited 2012 August 8.
 48. Université Catholique de Louvain. EM-DAT: The OFDA/CRED International Disaster Database. Brussels, Belgium, 2012.
 49. European Road Safety Observatory. *Annual Statistical Report*, 2011.
 50. Turkish Statistical Institute. *Traffic Accident Statistics Road*, 2011. Çankaya-ANKARA: Report No. 3605.

Anhang C: Studie 3

Knuth, D., Kehl, D., Hulse, L., Spangenberg, L., Brähler, E. & Schmidt, S. (*in press*) Risk perception and emergency experience: Comparing a representative German sample with German emergency survivors. *Journal of Risk Research*

Risk perception and emergency experience: comparing a representative German sample with German emergency survivors

D. Knuth^{a*}, D. Kehl^a, L. Hulse^b, L. Spangenberg^c, E. Brähler^c and S. Schmidt^a

^aDepartment of Health & Prevention, Institute of Psychology, Ernst-Moritz-Arndt-University of Greifswald, Greifswald, Germany; ^bFire Safety Engineering Group, Department of Mathematical Sciences, University of Greenwich, London, UK; ^cDepartment of Medical Psychology and Medical Sociology, Leipzig University, Leipzig, Germany

(Received 28 June 2013; final version received 11 March 2014)

People's perception of risk and its influencing factors has become an important element of research in past decades. The present paper investigated the influence of emergency experiences on risk perception and the impact of experience and gender on the accuracy of risk perception. A representative sample of the German population was subdivided into a general survivor group who had experienced at least one emergency previously ($N = 165$) and a general public group with no prior emergency experiences ($N = 2248$), which were compared to a German sample of survivors from the EU-funded Behavior, Security, and Culture (BeSeCu) international study of human behavior in emergency situations and evacuations ($N = 201$). The perceived risk of different emergencies – including larger-scale events like floods and other important but often overlooked events like domestic fires – was assessed with a questionnaire. Objective risk was also calculated for different emergencies and compared to the risk perceptions of each group to provide a measure of accuracy. The results of this study showed that emergency experiences increase perceived risk, for the experienced event in particular, and this outcome was evident regardless of whether the event was a large-scale one like a natural disaster or a smaller-scale one like a fire in one's home. Additional data from the BeSeCu survivors identified several pre-, peri-, and post-event factors that might have influenced this outcome. Further results included the finding that gender is an important factor that moderates the accuracy of risk estimations but researchers should be mindful that the presence and pattern of any gender difference in perceived risk accuracy may vary across different types of event. Possible reasons and implications of the results are discussed.

Keywords: risk perception; experience; survivor

Background

The psychological construct of risk perception is defined as the subjective judgment of people when characterizing and evaluating hazards (Slovic 1987, 1999) with perceived risk being the perceived likelihood of encountering a hazard (Gierlach, Bradley, and Beutler 2010). People's perception of different risks has become an important element of research in past decades (Cohen, Etner, and Jeleva 2007; Fischhoff, 1995; Kasperson et al. 1988; Lichtenstein et al. 1978; Slovic, Fischhoff,

*Corresponding author. Email: daniela.knuth@uni-greifswald.de

and Lichtenstein 1982), since it is important in order to learn more about the way people interpret and respond to risks, to improve safety communication, and to optimize the introduction of new prevention strategies (e.g. new regulations or safety products; Freudenburg 1988; Slovic 1987; Visschers and Siegrist 2008). Accurate risk perception can help to make well-informed decisions towards the risks and mobilize actions for prevention (Andersson 2011; Lichtenstein et al. 1978). Accordingly, some studies have found a positive association between risk perception and disaster preparedness (e.g. first aid knowledge, insurance, and emergency water and food supplies; Lee and Lemyre 2009; Lindell and Hwang 2008; Miceli, Sotgiu, and Settanni 2008; Yang et al. 2006).

Risk perception and experience

Personal experience with the event is one factor that has been shown to influence risk perception (e.g. Barnett and Breakwell 2001; Gow, Pritchard, and Chant 2008; Helweg-Larsen 1999; Ho et al. 2008; Kasapoglu and Mehmet 2004; Kellens et al. 2011; Lindell and Hwang 2008; Plapp and Werner 2004; Siegrist and Gutscher 2006). Barnett and Breakwell (2001) suggested that the impact of experience on the perceived risk for the event depends on the voluntariness of an event. For involuntary events, more experience and greater previous impact resulted in higher concern (Barnett and Breakwell 2001). Experiencing a disaster or an emergency situation can be considered as involuntary and investigations of risk perception after a disaster have usually been limited to large-scale disasters like floods or earthquakes, since people of a specific region could be contacted. For floods (Kellens et al. 2011; Siegrist and Gutscher 2006), tornadoes (Viscusi and Zeckhauser 2006), hurricanes (Viscusi and Zeckhauser 2006), and earthquakes (Kasapoglu and Mehmet 2004) it has been found that experience with the event increased risk perception for this event, which might be accurate due to the geographic factors influencing those events. Contrary results have been reported as well. A different study found that natural disaster experience was related to lower perceived risk for negative outcomes caused by the event (Halpern-Felsher et al. 2001) and experiencing a flood or an earthquake had no impact on perceived risk (Viscusi and Zeckhauser 2006). In order to explain these inconsistencies, it has been proposed that the effect of experience depends on the associated feelings with the event (Terpstra 2011). If the experience of a flood was associated with negative feelings, the perceived future risk of a flood was higher (Terpstra 2011). Furthermore Barnett and Breakwell (2001) concluded that experience is defined by an event's frequency, impact, and outcome and a great impact of an event on one's life can especially increase perceived risk. With respect to the accuracy of risk perception, it has been suggested that experience might lead to a more realistic evaluation of the corresponding objective risk (Sjöberg 2000).

One important theory underlying the effects of experiences on risk perception is the availability heuristic (Tversky and Kahneman 1973), which states that the probability estimations of people are mediated by the possibility to recall these events or similar cases in one's own environment. It is proposed that people assess the ease with which incidents can be recalled and, if recall of an event is easy (which it should be with personal experience), it will be perceived as more likely or more frequent than events which are more difficult to bring to mind (Tversky and Kahneman 1973).

Risk perception and objective measures

5 Much research has been done regarding the comparison of perceived risk with
objective risk estimations (Alm and Lindberg 2000; Andersson 2011; Horney et al.
2010; Kellens et al. 2011; Krasovskaia et al. 2001; Lichtenstein et al. 1978;
Loewenstein and Mather 1990). These objective risk estimations are often based on
10 statistics (Lichtenstein et al. 1978) or expert judgments (Kellens et al. 2011). Results
are mixed and depend on the incident investigated as well as several demographic
factors. Positive correlations between perceived risk and objective risk have been
found with respect to floods (Horney et al. 2010; Kellens et al. 2011), different
causes of death (Lichtenstein et al. 1978), and problems like unemployment, infla-
15 tion, or crime (Loewenstein and Mather 1990). Participants seem to be quite able to
estimate correct rank orders of risks (Alm and Lindberg 2000; Lichtenstein et al.
1978) but they fail to evaluate the real numbers (Andersson 2011; Horney et al.
2010; Krasovskaia et al. 2001; Lichtenstein et al. 1978). In general, low frequency
events or risks tend to be overestimated and high frequency events and risks tend to
20 be underestimated (Hakes and Viscusi 2004; Lichtenstein et al. 1978; Sjöberg 1999,
2000; Slovic, Fischhoff, and Lichtenstein 1979). Among the most overestimated
events in the study of Lichtenstein et al. (1978) were floods and all kinds of acci-
dents since they were considered rather sensational events. Consequently, and in
contrast to objective risk assessment or experts' evaluation of risks, subjective risk
perception appears to integrate qualitative factors like controllability, severity, conse-
25 quences, and familiarity with an event (Gregory and Mendelsohn 1993; Slovic,
Fischhoff, and Lichtenstein 1979).

Impact of personal characteristics

Personal characteristics have also been found to be influential, e.g. women have
reported higher risk perception values than have men (Andersson 2011; Armas
2006; Ho et al. 2008; Kellens et al. 2011; Lindell and Hwang 2008), women have
30 rated their road mortality risk more accurately when age-related objective risk has
been considered (Andersson 2011) and women's estimations of different causes of
death have been found to become more accurate with increasing age (Hakes and
Viscusi 2004). Higher perceived risk concerning earthquakes (Armas 2006) and
floods (Kellens et al. 2011) has been found with increasing age and, for married peo-
35 ple, the perceived risk of terrorism has been found to be higher when compared to
non-married people (Eisenman et al. 2009). Furthermore road mortality risk percep-
tion (Andersson 2011) and estimations of different causes of death (Hakes and
Viscusi 2004) have been found to be more accurate for people educated to a higher
level.

40 In conclusion, it has been found that experiencing a large-scale disaster can ele-
vate the level of perceived risk for this type of event. Are these results also true for
rather smaller-scale events like building fires, which are not restricted by geographi-
cal factors? While such events may be smaller-scale in terms of the numbers of peo-
ple and properties affected in each individual case, they are not small scale in terms
45 of the numbers which occur annually, particularly domestic fires which are the main
source of fire-related injuries and deaths and carry a considerable cost in terms of
property damage (e.g. Brushlinsky et al. 2008). Previous research lacks the investi-
gation of fire-risk perception with respect to people who have experienced a fire in a

domestic or public building. Although research has been done concerning experience and the perceived risk of wild fires, the results might depend on the specificity of this type of event which also depends on geographical factors as well as climatic conditions. Therefore, some regions might be more prone to wild fires than others whereas fires in domestic or public settings can and do happen all over the world. Additionally, fires in domestic and public buildings may receive less media coverage and may have a more sudden, unexpected onset than wild fires and so people's perceptions of and preparedness for them may differ. Furthermore, as described earlier, objective risk and perceived risk often differ with people overestimating low frequency events and underestimating high frequency events. But how does experience, and therefore a possible increase in perceived risk, influence the accuracy of risk perception? For example, does experience of a disaster, or even a relatively smaller-scale emergency like a building fire, lead to a more realistic risk perception of the event or does it lead to an overestimation of risks? Additionally, do these impacts differ according to personal characteristics, particularly gender, as might be suggested by the results of Andersson (2011)?

The present paper examines the effects of emergency experiences on risk perception relating to specific types of events and the comparability of perceived and objective mean risk. Risk perception was investigated regarding five different emergency situations including the risk for domestic and public building fire events. Perceived risk was then compared to objective risk rates in all groups in order to determine a possible impact of experience on the difference between perceived risk and objective risk for the event. In accordance with the risk perception literature, it was hypothesized that:

- (1) Participants with prior emergency experience would report an elevated level of perceived risk compared to the sample with no emergency experience.
- (2) Perceived risk would differ from the objective risk for the corresponding event, with risks for terrorism and floods being overestimated (due to being larger-scale, 'sensational' events) and risks for fires as well as traffic accidents being underestimated (due to being smaller-scale, more 'everyday' events, at least in the eyes of the media).
- (3) Gender as well as emergency experience might influence the accuracy of risk perception.

Method

Samples

Survivors sample

A sample of 1112 citizens was drawn from the EU-funded Behavior, Security, and Culture (BeSeCu) project (Schmidt and Galea 2013), an international investigation of human behavior in emergency situations and evacuations. This sample had survived, that is personally experienced, a fire in a domestic or public setting, an earthquake, a terrorist attack, or a flood in one of the European countries where project partners were based (i.e. Germany, Czech Republic, Poland, Sweden, Spain, Turkey, UK, and Italy). All participants gave their informed consent and met the following inclusion criteria: (1) they were at least 18 years old; (2) the emergency services attended the incident; and (3) the emergency did not happen any earlier than 1999. Participants'

5 reactions before, during, and after the specific event were obtained through a
self-report instrument (Knuth et al. 2013) which was the result of a cross-national
development process (Knuth, Kehl, and Schmidt 2013) including literature review,
expert consultations, focus groups with survivors and first responders, and a pretest.
10 For this present study, only the 201 survivors resident in Germany who experienced
either a flood, a terrorist attack or a fire (referred to here as *BeSeCu-s*) were included.

General population sample

A cross-sectional, population-based survey was carried out by an independent Insti-
tute for Social Research (USUMA, Berlin) with a randomly selected sample repre-
sentative of the general German population. Germany was subdivided into 258
15 sample points representing the different regions of the country. Inclusion criteria
were being at least 14 years old and having sufficient ability to understand the
German language in written form. Study assistants visited the participants, informed
them about the study and presented self-rating questionnaires. All participants gave
their informed consent. For minors, parents gave their consent. Data collection took
20 place in June and July 2011. The initial sample consisted of 4386 addresses of
which 4327 were valid. In total, 2555 participants completed the study.

In order to investigate differences in risk perception between survivors of emer-
gency incidents and people with no emergency experience, a subdivision of the repre-
sentative sample was necessary. The representative sample was asked about
25 experiences with fires, floods, and terrorist attacks, and people who reported having
experienced at least one of these events were combined in the group of general survi-
vors (*general-s*). Participants who did not answer these questions had to be eliminated
from the study. Furthermore, all participants from the representative sample aged
17 and younger were also excluded in order to enhance the comparability to the
30 *BeSeCu* sample. A differentiation between survivors from the *BeSeCu* study and the
general population sample was made since the inclusion criteria concerning the event
(i.e. the event was no longer than 11 years ago and the emergency services were
involved) were not put to the latter group and the purpose of the two surveys was dif-
ferent which might affect the risk ratings; this will be discussed later. Of the general
35 population sample of 2413 participants, 2.82% had already experienced a house fire
incident, 3.77% a flood, and .58% had already experienced a terrorist attack. There-
fore, 6.84% ($N = 165$) of the participants in the general population sample had experi-
enced at least one of these events and comprised the group of *general-s*. The general
population sample, therefore, included 2413 participants, consisting of 165 *general-s*
40 and 2248 participants with no emergency experience (*general public*).

Incident experiences

Direct emergency experience was the main inclusion criterion for all *BeSeCu* partici-
pants. Participants answered a detailed questionnaire concerning the event in ques-
tion (Knuth et al. 2013) which included pre-event factors like emergency-relevant
45 knowledge, emotional and cognitive reactions during the event (e.g. emotional dis-
tress, threat perception, panic-like symptoms, and perceived control), and the conse-
quences of the event (e.g. injuries, property damage, impacted life domains, and
post-event distress). Furthermore, *BeSeCu* participants were asked about prior
emergency experiences: *Before the incident occurred, had you ever experienced any*

6 D. Knuth et al.

of the following incidents? Please tick all that apply. (Answer options were: A fire in a home; a terrorist attack; a fire in a public building; a flood). For the general population sample the experience question was slightly different: *Have you ever been affected by any of the following incidents (e.g. by evacuation, injuries, or damages)? Please tick all that apply. (Answer options: a house fire; a terrorist attack; a flood).*

5

Perceived risk

10

The same risk perception items were used in all samples to assess subjective risk perception with respect to different emergency events. Participants were asked: *In your opinion, how likely is it that, in the future, you will become a victim of the following emergency situations?* Perceived risk regarding the incidents a domestic fire, a fire in a public building, a terroristic attack, a flood, and a traffic accident were assessed by evaluating the likelihood on a scale from 0 to 100%.

15

Objective risk

To compare the subjective perceived risk to an objective measure, the objective risk needed to be calculated. For a given year or time period, the number of incidents as well as the mean population during this time were used to calculate the objective individual mean risk for the incidents (see Table 1). The objective risk rates in this paper, therefore, represent mean risk calculation for the German population.

20

All calculations were based on statistics for events in Germany only. The risk of experiencing a fire incident was calculated based on the number of fire incidents in one year and the mean population in that year. Lifetime risk was calculated by dividing the risk for one year by the mean life expectancy in Germany (79.8 years [Destatis 2011]). With respect to possible gender differences, the objective risk numbers for men and women regarding traffic accidents and fires were also calculated. Gender-specific data were not available for the other events. The lifetime risks for getting injured in a traffic accident were 41.44% for men and 31.88% for women and were based on gender-specific data (Destatis 2011). The lifetime risk for

25

30

AQ12 Table 1. Objective risk assessment for Germany.

Incident	Year	Number	Lifetime risk %
Fire Incidents ^a	2006	187,604	18.16
Being killed	2006	424	.04
Terrorist attacks ^b	1990–2010	554	.0027
Being injured	1990–2010	466	.0023
Being killed	1990–2010	43	.0002
Floods ^c	1900–2012	14	.00
Affected	1900–2012	536,758	.47
Traffic accidents ^d	2010	2,411,271	235.37
Being injured	2010	374,818	36.59
Being killed	2010	3,648	.36

^aBrushlinsky et al. (2008).

^bNational Consortium for the Study of Terrorism and Responses to Terrorism (2011).

^cUniversité Catholique de Louvain (2012).

^dDestatis (2011).

experiencing a fire was based on gender-specific data concerning fire deaths (Deutscher Feuerwehrverband e.V. 2009), since gender-specific data for fire experiences were not available. The ratio of 59% male fire deaths and 41% female fire victims was applied to the lifetime risk for experiencing a fire. Accordingly, the risk for women was 14.89% and for men 21.43%.

Data analysis

Analysis of variance (ANOVA), χ^2 tests, as well as their corresponding effect sizes Cramer's V and η , were calculated to test differences in mean risk perception values between the three groups. A hierarchical regression analysis was conducted in order to control the impact of socio-demographic differences and to analyze the impact of prior experiences on incident-specific perceived risk. Categorical variables with more than two categories were transformed into indicator variables using dummy coding. Blockwise entry was used and socio-demographic information was entered first, followed by the indicator variable of the different groups. Two identical regression analyses were performed differing only in the sample group that was used as the reference. In Model 2a, the general public sample was the reference, whereas the BeSeCu-s group was used as the reference in Model 2b. Multicollinearity was investigated using the tolerance statistic and VIF values. Incident-specific regression analyses were done with the subsamples of domestic fire survivors as well as flood survivors of the BeSeCu-s sample using backward elimination. In order to investigate the accuracy of risk perception, mean differences between perceived risk and objective risk (M_{Diff}) were calculated and then tested in each sample in a one-sample t -test against zero. Objective fire risk for the three groups was calculated by the mean risk for domestic fires and fires in a public building. Further analyses of the impact of experiences and gender on the accuracy of risk perception were done by dividing the two survivor samples into participants who only experienced the specific event in question and no others, and participants who never experienced that specific event and, therefore, only other events. Kruskal-Wallis-Test was applied in order to compare the accuracy of risk perception between the different groups. All analyses were conducted using SPSS 21.0 computer software.

Results

Sample characteristics

Socio-demographic characteristics of the three groups BeSeCu-s ($n = 201$), General public ($n = 2248$), and General-s ($n = 165$) are presented in Table 2. The inquiry of annual net income used three categories which were adapted according to the average annual net income in Germany (GfK AG 2008). The three categories display percentages, though modified, based around a suggested definition of middle class (Grabka and Frick 2008): 1 = less than 70% of annual net income; 2 = between 70% and 150% of annual net income; and 3 = more than 150% of annual net income. Furthermore, Table 2 presents prior emergency experiences of the two survivor groups.

Direct experience and risk perception

Mean perceived risk is shown in Table 3 as are ANOVA results. Mean perceived risk regarding each of the five incidents differs significantly between the three samples. Medium effect sizes were found for the differences between the groups in

Table 2. Socio-demographic characteristics of the samples ($N=2614$).

	BeSeCu-s $n=201$		General public $n=2248$		General-s $n=165$		χ^2	df	p	$C'V$
	n	%	n	%	n	%				
Male gender	88	43.8	1065	47.4	79	47.9	1.00	2	.608	.02
Marital status ^a							94.00	6	<.001	.13
Single	106	53.0	536	23.8	32	19.4				
Married	77	38.5	1163	51.7	83	50.3				
Divorced	12	6.0	275	12.2	24	14.5				
Widowed	5	2.5	274	12.2	26	15.8				
Qualifications ^b							239.16	8	<.001	.21
No formal	0	.0	64	2.9	5	3.1				
Lowest	20	10.1	903	40.3	64	39.3				
Intermediary	58	29.1	900	40.2	70	42.9				
Higher	59	29.6	192	8.6	10	6.1				
University	62	31.2	180	8.0	14	8.6				
Income ^c							64.15	4	<.001	.11
<13.114,-€	66	34.2	1000	45.4	67	41.6				
13.114,-€- 28.101,-€	89	46.1	1088	49.4	85	52.8				
>28.101,-€	38	19.7	115	5.2	9	5.6				
Experiences										
Fire	169	84.1	—	—	68	41.2	72.96	1	<.001	-.45
Flood ^a	55	27.5	—	—	91	55.2	28.80	1	<.001	.28
Terror ^a	4	2.0	—	—	14	8.5	8.11	1	<.01	.15
Age ^a $M(SD)$	41.22 (15.58)		50.39 (17.45)		51.81 (16.87)				$F(2,2610)=27.07; p<.001$	

^a1 (.0%) Missing.^b13 (.5%) Missing.^c57 (2.2%) Missing.

Table 3. Mean total perceived risk for each sample.

	BeSeCu-s		General public		General-s		F	df1/df2	p	η
	M	SD	M	SD	M	SD				
Fire (domestic)	29.66 ^a	28.56	12.00 ^a	16.40	16.61 ^a	18.99	91.64	2/2577	<.001	.26
Fire (public)	22.10 ^a	24.21	7.86 ^a	12.74	11.61 ^a	18.24	90.99	2/2564	<.001	.26
Terrorist attack	14.17 ^a	22.10	7.79 ^{ab}	14.13	10.95 ^b	16.88	18.29	2/2555	<.001	.12
Flood	19.47 ^a	27.89	3.63 ^a	8.93	9.53 ^a	18.09	162.29	2/2550	<.001	.34
Traffic accident	51.30 ^a	30.68	28.86 ^a	25.93	34.24 ^a	26.99	66.95	2/2596	<.001	.22

^{a,b} = the same character on mean risk perception values means that these two means differ significantly ($p < .05$) in analysis of variance followed by Bonferroni post hoc tests.

perceived risk for fires in domestic and public settings and floods. All three groups indicated a traffic accident as the incident which was most likely to happen to them and a domestic fire as the second likeliest event.

5 Since the samples differed with respect to socio-demographics, hierarchical regression analyses were conducted in order to control the influence of these factors. Results are displayed in Table 4. In summary, the final model explained 2–13% of

Table 4. Hierarchical regression analyses regarding incident-specific perceived risk.

	Domestic fire β	Public fire β	Terror β	Flood β	Traffic β
<i>Step 1</i>	$R^2 = .01^{**}$	$R^2 = .01^{***}$	$R^2 = .01^*$	$R^2 = .02^{***}$	$R^2 = .01^{**}$
Gender	.00	.01	.00	.00	.01
Age	-.03	-.11 ^{***}	-.08 ^{**}	-.10 ^{***}	-.09 ^{**}
Relationship status					
Married (Single = ref)	.02	.05	.10 ^{***}	.09 ^{**}	.02
Divorced (Single = ref)	-.01	.02	.05 [*]	.04	.00
Widowed (Single = ref)	.07 [*]	.07 [*]	.10 ^{***}	.05	.05
Qualifications					
No (Highest = ref)	-.01	.00	-.03	.02	-.00
Lowest (Highest = ref)	-.01	.01	-.05	.05	.00
Medium (Highest = ref)	.03	.01	-.03	.06	.02
High (Highest = ref)	-.01	-.01	-.03	.02	-.02
Income					
Low (High = ref)	.14 ^{***}	.09 [*]	.03	.07	.02
Medium (High = ref)	.11 ^{**}	.10 ^{**}	.04	.04	.01
<i>Step 2a</i> (General public = ref)	$R^2 = .08^{***}$	$R^2 = .07^{***}$	$R^2 = .02^{***}$	$R^2 = .13^{***}$	$R^2 = .06^{***}$
BeSeCu-s	.27 ^{***}	.26 ^{***}	.11 ^{***}	.34 ^{***}	.22 ^{***}
General-s	.06 ^{**}	.06 ^{**}	.05 [*]	.11 ^{***}	.05 [*]
<i>Step 2b</i> (BeSeCu-s = ref)	$R^2 = .08^{***}$	$R^2 = .07^{***}$	$R^2 = .02^{***}$	$R^2 = .13^{***}$	$R^2 = .06^{***}$
General-s	-.19 ^{***}	-.18 ^{***}	-.06 [*]	-.20 ^{***}	-.16 ^{***}
General public	-.35 ^{***}	-.34 ^{***}	-.15 ^{***}	-.45 ^{***}	-.29 ^{***}

* $p < .050$.
** $p < .010$.
*** $p < .001$.

variance in the incident-specific risk perception values. The results confirm group differences found with *post hoc* tests of analyses of variance. Only one additional difference was observed for perceived risk concerning terrorist attacks: the difference between general-s and BeSeCu-s reached statistical significance (see Table 4).

More experience analyses for the samples of BeSeCu-s and general-s are displayed in Table 5. Results suggest that experience with a particular type of event predicts perceived risk for this specific type of event, and the differences in perceived risk between general-s and BeSeCu-s persist even with the emergency experience factors controlled.

Pre-, peri-, and post-event factors impacting perceived risk for experienced events

The mean time since the event for the BeSeCu-s sample was 2.66 years (SD = 3.18) for domestic fires, 5.67 years (SD = 3.67) for floods, and 2.04 years (SD = 3.09) for public fire incidents. Further regression analyses in the BeSeCu-s sample only investigated the factors of experience that might impact risk perception by using other data collected in the BeSeCu study. In the sample of BeSeCu domestic fire survivors ($n = 89$), it was found that domestic fire risk perception was affected by low

Table 5. Hierarchical regression analyses regarding incident-specific perceived risk (only BeSeCu-s and general-s samples).

	Domestic fire β	Public fire β	Terror β	Flood β	Traffic β
<i>Step 1</i>	$R^2 = .10^{***}$	$R^2 = .13^{***}$	$R^2 = .06$	$R^2 = .23^{***}$	$R^2 = .14^{***}$
Gender	.00	.06	.08	.03	.00
Age	-.15	-.40 ^{***}	-.19*	-.20 ^{**}	-.34 ^{***}
Relationship status					
Married (Single = ref)	.07	.17*	.19*	.11	.16*
Divorced (Single = ref)	.00	.09	.07	.08	.04
Widowed (Single = ref)	.03	.14	.16*	.06	.18*
Qualifications					
No (Highest = ref)	-.08	-.09	.03	.05	-.08
Lowest (Highest = ref)	.01	.05	-.06	.09	-.02
Medium (Highest = ref)	.04	.00	.03	.14*	.02
High (Highest = ref)	-.08	-.07	-.12	-.01	-.09
Income					
Low (High = ref)	.19*	.00	.00	.04	.00
Medium (High = ref)	.12	.05	.02	.01	.07
Experiences					
Fire	.23*	.24 ^{**}	.06	.11	.24 ^{**}
Flood	.07	.22*	.11	.55 ^{***}	.23 ^{**}
Terror	.05	.09	.14*	.10	.02
<i>Step 2</i> (BeSeCu-s = ref)	$R^2 = .13^{***}$	$R^2 = .15^{***}$	$R^2 = .08^*$	$R^2 = .31^{***}$	$R^2 = .17^{***}$
General-s	-.20 ^{**}	-.17*	-.18*	-.36 ^{***}	-.23 ^{***}

* $p < .050$.
^{**} $p < .010$.
^{***} $p < .001$.

education (high = reference) $\beta = -.23$, $p < .05$, emotional distress at realization $\beta = -.29$, $p < .05$, panic-like symptoms $\beta = .24$, $p < .05$, and post-event distress $\beta = .27$, $p < .05$ (adjusted $R^2 = .13$, $p < .01$). Risk perception concerning future floods was investigated within the BeSeCu sample of flood survivors ($n = 31$) and the following factors reached statistical significance: the time since the event $\beta = -.57$, $p < .001$, low education (high = reference) $\beta = .36$, $p < .05$, and emergency-relevant knowledge $\beta = .32$, $p < .05$ (adjusted $R^2 = .43$, $p < .001$).

Accuracy of perceived risk

Comparisons between perceived risk and objective measures of risk were done concerning all events. A positive difference value (M_{Diff}) represents an overestimation of the objective risk, whereas a negative value stands for an underestimation of the objective risk.

Terrorism risk

The objective risk concerning a terrorist attack [BeSeCu-s: $M_{Diff} = 14.17$; SD = 22.10; $t(193) = 8.93$; $p < .001$; $d = .64$; general-s: $M_{Diff} = 10.95$; SD = 16.88; $t(159) = 8.20$; $p < .001$; $d = .65$; general public: $M_{Diff} = 7.79$; SD = 14.13; $t(2203) = 25.90$; $p < .001$; $d = .55$] was overestimated in all samples.

Risk for experiencing a terrorist attack was overestimated by men in the BeSeCu-s sample [$M_{Diff} = 13.84$; SD = 23.82; $t(83) = 5.32$; $p < .001$; $d = .58$], in the general-s sample [$M_{Diff} = 8.03$; SD = 10.94; $t(77) = 6.48$; $p < .001$; $d = .73$], and in the general public sample [$M_{Diff} = 7.82$; SD = 13.78; $t(1043) = 18.34$; $p < .001$; $d = .57$].

Women in the BeSeCu-s sample [$M_{Diff} = 14.42$; SD = 20.79; $t(109) = 7.27$; $p < .001$; $d = .69$], the general public sample [$M_{Diff} = 7.77$; SD = 14.44; $t(1159) = 18.33$; $p < .001$; $d = .54$], and the general-s sample [$M_{Diff} = 13.73$; SD = 20.73; $t(81) = 6.00$; $p < .001$; $d = .66$] overestimated their terrorist attack risk.

Risk for traffic accidents

The mean difference between subjective and gender-specific objective risk concerning a traffic accident was significant for BeSeCu-s [$M_{Diff} = 15.25$; SD = 30.75; $t(196) = 6.96$; $p < .001$; $d = .50$] and the general public sample [$M_{Diff} = -7.55$; SD = 26.46; $t(2237) = -13.50$; $p < .001$; $d = .29$], but not in the general-s sample [$M_{Diff} = -2.24$; SD = 27.68; $t(163) = -1.04$; $p = .300$; $d = .08$].

Men overestimated their specific objective risk for getting injured in a traffic incident in the BeSeCu-s sample [$M_{Diff} = 12.06$; SD = 31.68; $t(85) = 3.53$; $p < .01$; $d = .38$] and underestimated that risk in the general public sample [$M_{Diff} = -13.16$; SD = 25.17; $t(1059) = -17.02$; $p < .001$; $d = .52$], as well as in the general-s sample [$M_{Diff} = -8.78$; SD = 26.46; $t(78) = -2.95$; $p < .01$; $d = .33$].

Women overestimated their specific objective risk for getting injured in a traffic accident in the BeSeCu-s sample [$M_{Diff} = 17.72$; SD = 29.92; $t(110) = 6.24$; $p < .001$; $d = .59$], underestimated the risk in the general public sample [$M_{Diff} = -2.50$; SD = 26.59; $t(1177) = -3.23$; $p < .01$; $d = .09$] and estimated the risk correctly in the general-s sample [$M_{Diff} = 3.83$; SD = 27.56; $t(84) = 1.28$; $p = .204$; $d = .14$].

Table 6. Mean differences between perceived and objective flood risk.

	BeSeCu-s Flood experiences			General-s Flood experiences			General-public (n = 2199) M _{Diff} (SD)	Global comparison		
	Yes, only (n = 32) M _{Diff} (SD)	Never (n = 139) M _{Diff} (SD)	Yes vs. never H (df); η	Yes, only (n = 81) M _{Diff} (SD)	Never (n = 71) M _{Diff} (SD)	Yes vs. never H (df); η		H	df	η
Accu Flood	48.66 (32.32)	8.70 (16.40)	50.67***(1); .55	13.36 (20.66)	3.15 (9.37)	26.72***(1); .42	3.16 (8.93)	201.68***	4	.28
Men	47.61 (35.74)	10.21 (18.45)	17.82***(1); .50	9.68 (15.38)	2.31 (5.28)	9.89***(1); .37	2.78 (7.89)	85.02***	4	.27
Women	49.37 (30.76)	7.58 (14.73)	32.62***(1); .58	16.94 (24.43)	3.84 (11.74)	17.27***(1); .47	3.50 (9.76)	117.09***	4	.30
Men vs. Women H (df); η	.00(1); .00	.00(1); .00		1.87(1); .15	.05(1); .03		1.22(1); .02			

*** $p < .001$.

Table 7. Mean differences between perceived and objective fire risk.

	BeSeCu-s Fire experiences			General-s Fire experiences			General-public (n = 2248) <i>M_{Diff}</i> (SD)	Global comparison		
	Yes, only (n = 133) <i>M_{Diff}</i> (SD)	Never (n = 32) <i>M_{Diff}</i> (SD)	Yes vs. never <i>H</i> (df); η	Yes, only (n = 61) <i>M_{Diff}</i> (SD)	Never (n = 97) <i>M_{Diff}</i> (SD)	Yes vs. never <i>H</i> (df); η		<i>H</i>	df	η
Accu fire	9.27 (24.56)	.86 (24.82)	3.63(1); .15	-4.17 (13.16)	-4.13 (17.48)	1.25(1); .09	-7.99 (13.78)	101.36***	4	.20
Men	3.50 (22.88)	-11.18 (10.17)	5.42*(1); .28	-6.30 (14.78)	-8.79 (14.12)	1.68(1); .15	-11.87 (12.35)	50.20***	4	.21
Women	13.52 (25.03)	8.89 (28.53)	.46(1); .07	-2.55 (11.75)	.64 (19.36)	.00(1); .00	-4.51 (14.07)	65.08***	4	.22
Men vs. Women <i>H</i> (df); η	6.83**(1); .23	11.56***(1); .63		2.65(1); .21	12.11***(1); .36		377.34***(1); .41			

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Flood risk

The objective flood risk was overestimated in all samples [BeSeCu-s: $M_{Diff}=19.00$; SD = 27.89; $t(194)=9.51$; $p < .001$; $d = .68$; general-s: $M_{Diff}=9.06$; SD = 18.09; $t(158)=6.32$; $p < .001$; $d = .50$; general public: $M_{Diff}=3.16$; SD = 8.93; $t(2198)=16.61$; $p < .001$; $d = .35$]. 5

The objective risk of experiencing a flood was overestimated by men in the BeSeCu-s sample [$M_{Diff}=21.01$; SD = 30.18; $t(84)=6.42$; $p < .001$; $d = .70$], in the general-s sample [$M_{Diff}=6.71$; SD = 13.34; $t(76)=4.42$; $p < .001$; $d = .50$], and in the general public sample [$M_{Diff}=2.78$; SD = 7.89; $t(1036)=11.36$; $p < .001$; $d = .35$]. 10

Similarly, women in the BeSeCu-s sample [$M_{Diff}=17.45$; SD = 26.03; $t(109)=7.03$; $p < .001$; $d = .67$], the general-s sample [$M_{Diff}=11.27$; SD = 21.47; $t(81)=4.75$; $p < .001$; $d = .52$], and the general public sample [$M_{Diff}=3.50$; SD = 9.76; $t(1161)=12.24$; $p < .001$; $d = .36$] all overestimated their objective flood risk. 15

Risk for fire incidents

The mean difference between gender-specific objective and perceived risk for experiencing a fire was significantly different from zero in all three samples: BeSeCu-s [$M_{Diff}=8.18$; SD = 24.64; $t(197)=4.67$; $p < .001$; $d = .33$], general-s [$M_{Diff}=-3.81$; SD = 16.81; $t(161)=-2.88$; $p < .01$; $d = .23$], and general public sample [$M_{Diff}=-7.99$; SD = 13.78; $t(2223)=-27.35$; $p < .001$; $d = .58$]. 20

The objective risk of experiencing a fire was estimated correctly by men in the BeSeCu-s sample [$M_{Diff}=2.96$; SD = 22.77; $t(86)=1.21$; $p = .229$; $d = .13$], but underestimated in the general-s sample [$M_{Diff}=-7.55$; SD = 15.56; $t(77)=-4.28$; $p < .001$; $d = .49$] and in the general public sample [$M_{Diff}=-11.87$; SD = 12.35; $t(1052)=-31.19$; $p < .001$; $d = .96$]. 25

Women in the BeSeCu-s sample overestimated their objective fire risk [$M_{Diff}=12.28$; SD = 25.37; $t(110)=5.10$; $p < .001$; $d = .48$], whereas women in the general public sample underestimated their risk [$M_{Diff}=-4.51$; SD = 14.07; $t(1170)=-10.96$; $p < .001$; $d = .32$] and the difference did not significantly differ from zero in the general-s sample [$M_{Diff}=-.34$; SD = 17.28; $t(83)=-.18$; $p = .859$; $d = .02$]. 30

AQ14
AQ15

Tables 6 and 7 display the mean differences between perceived risk and objective risk with respect to fires and floods differentiated for men and women as well as for participants with and without this specific experience. 35

Discussion

The goal of this study was to investigate the influence of emergency experiences on risk perception with respect to different incidents. Furthermore, the study investigated the impact of experience and gender on the accuracy of perceived risk. 40

Direct experience and risk perception

The first hypothesis stated that people with emergency experience would report higher perceived risk compared to participants with no emergency experience. First of all, the findings support this hypothesis since the samples with emergency 45

experience reported significantly higher perceived risk for each event compared to the sample with no emergency experience. The highest values were found among the BeSeCu-s sample, followed by the general-s, and then the general public sample. The greatest impact was found for flood experience on perceived risk of a flood. The results are in line with the availability heuristic hypothesis, since the general public sample had no direct experience with the events in question and, therefore, recalling an event might have been more difficult, which led to lower risk perception values for the corresponding events (Tversky and Kahneman 1973).

Nevertheless, even after controlling for emergency experience the differences between BeSeCu-s and general-s in terms of perceived risk remained present for all events. In this regard, a possible influence of salience of the event is worth discussing. In a previous study (Vastfjall, Peters, and Slovic 2008), a sample of people not directly affected by the Tsunami of 2004 was reminded of the event which led to increased perceived risk for negative and decreased perceived risk for positive life events (Vastfjall, Peters, and Slovic 2008). Although questions regarding risk perception were asked at the beginning of the BeSeCu questionnaire, before answering detailed questions about the event experienced, people were already reminded of the event since the entire questionnaire concerned this event and the event itself was an inclusion criterion. For the general population samples, these questions were asked in a different context which was not primarily concerned with the experience of an emergency event. Yet, another possible explanation for the elevated perceived risk in the BeSeCu-s sample is the fact that one inclusion criterion requested the involvement of the emergency services for the incidents which was not the case for the general-s sample. As a result, it could be suspected that the incidents experienced by the BeSeCu-s sample might have been more severe. Indeed, previous results indicate that the impact of previous experiences is important, with high impact (Barnett and Breakwell 2001) or negative feelings associated with the event (Terpstra 2011) resulting in higher concern. Additional investigation of the BeSeCu-s sample revealed that, amongst other factors, emotional reactions during and after the event predicted perceived risk for domestic fires.

BeSeCu-s' perceived risk for floods on the other hand was mainly influenced by the time since the last event and emergency-relevant knowledge. This result demonstrates the impact of the passing of time since the experience. For BeSeCu-s the event occurred within the last 11 years (i.e. not before 1999) but for the general-s there was no such criterion, therefore, people may also have considered experiences before 1999. A large number of BeSeCu-s participants had actually experienced the event within three years prior to the survey and it is possible, especially considering the results concerning flood risk perception, that perceived risk increases after experiencing an emergency event, remains at a higher level for a longer period of time and decreases again after a period without any incidents. This process of perceived risk was found in a study concerning the 1994 Northridge earthquake (Helweg-Larsen 1999). Immediately after the earthquake, and even five months later, no optimistic bias for earthquakes and, therefore, no underestimation of personal risk was found in a student sample. Longitudinal studies are needed in order to determine how long these possible changes persist. The present results support the impact of direct hazard experience on risk perception but further dimensions of one's personal experience need to be taken into account as well. Furthermore, the impact of experience on risk perception was larger for floods compared to fire incidents, which suggests that characteristics of the different types of event should also be given deeper consideration.

Accuracy of perceived risk

To test the second hypothesis – that people’s perceived risk would not match the objective risk – objective risk for the incidents was compared to the perceived risk. In general, people in all three samples adhered to the objective risk order of the events, which is in line with previous findings (Alm and Lindberg 2000). Nevertheless, as hypothesized, the perceived risk for experiencing a terrorist attack and a flood in Germany was overestimated in all three samples. For traffic accidents and fire incidents the results differ from that hypothesized, especially in the BeSeCu-s sample. BeSeCu-s participants also overestimated these two objective risks whereas the general public sample (as hypothesized) underestimated those risks. The general-s sample underestimated the fire risk but rated the traffic risk accurately. In conclusion, the hypothesis was confirmed for the sample with no prior emergency experiences, but not entirely confirmed in the samples with emergency experiences.

With hypothesis three, it was suggested that not only emergency experience but also gender might influence the accuracy of risk perception. This was investigated for fire and flood risk. Although men and women with no emergency experiences underestimated their specific objective risks for fire and traffic accidents, women were much closer to their objective risks than were men. This trend was also found in the general-s sample. Men underestimated both risks whereas women estimated both risks correctly. In the BeSeCu-s sample a contrary effect was found. Women overestimated both risks whereas men only overestimated their traffic accident risk and estimated their fire risk correctly. Incident-specific analyses revealed that the effect of experience on accuracy was larger for floods and especially for women. The effects on the accuracy of fire risk were rather small except for men in the BeSeCu-s sample. For the accuracy of flood risk the experience effects were large in the BeSeCu-s and general-s sample compared to the fire experience effects on fire risk accuracy. To summarize then, the results of the present study were generally consistent with hypothesis three and with some previous results reported by researchers such as Andersson (2011) by indicating an impact of gender as well as emergency experience on the accuracy of risk perception. However, the results further indicate that a general investigation of accuracy might lead to false conclusions. In other words, it should not be assumed that men and women will always perceive their risk differently to either objective estimations of the risk or to each other, and that any differences will always be in the same direction for any emergency event.

Clearly, how people judge the risk of an event is a complex matter. One possible explanation for the underestimation of the risk of the more common but smaller-scale events in the general public sample might be the tendency to estimate the risk to oneself below the risk to others (Gierlach, Bradley, and Beutler 2010; Sjöberg 2000), or average risk (Viscusi and Zeckhauser 2006), which is referred to as a positive or optimistic bias. In this context, it is important to note that people here rated their personal risk whereas the objective risk calculations can rather be seen as general risk. Therefore, ratings of general risk might be higher (Krasovskaia et al. 2001; Plapp and Werner 2004; Sjöberg 2000) which could eliminate the underestimation of risk found in the general public sample.

The results for the impact of socio-demographic variables in this study need to be considered as well. In contrast to previous results (Andersson 2011; Armas 2006; Ho et al. 2008; Kellens et al. 2011; Lindell and Hwang 2008), gender had no significant main effect on perceived risk. Neither in the two general population samples

5

10

15

20

25

30

35

40

45

50

nor in the BeSeCu sample did gender alone impact the risk rating for the events. This result is quite novel, although a similar finding was reported in an older French study (Bastide et al. 1989). A possible explanation might be the fact that in this study it was the likelihood of personally experiencing the events that was investigated; in other studies, gender effects were often found when risk perception focused on dread for events (Ho et al. 2008; Kellens et al. 2011) or the negative consequences of an event (Lindell and Hwang 2008). Ho et al. (2008) found no impact of gender on likelihood ratings when it was the likelihood of the event occurring to the participant's community.

In the present study, older participants had lower risk perception values for almost all incidents which is also in contrast to previous results (Armas 2006; Kellens et al. 2011) that proposed a positive relationship between these variables. This result might be due to the fact that the mean age of the participants in the general-s and general public sample was about 10 years higher than the age of the BeSeCu-s participants. A possible cohort effect might also be possible with older participants having been through worse, e.g. World War II, and, therefore, consider other emergencies as less threatening. The effect of income on the perceived risk of fires matched that previously found by others (Lee, Lemyre, and Krewski 2010; Lindell and Hwang 2008; Turvey et al. 2010) with lower income resulting in higher risk perception values. Furthermore, an influence of marital status was found for terrorism, fire, and flood perceived risk with married or widowed participants having higher values than singletons. This result was previously found for worry about terrorism, with married people worrying more than non-married people (Eisenman et al. 2009). Therefore, the present study bolsters the conclusion that people's personal circumstances play an important role in the way they perceive future risks to themselves.

Limitations

With regard to the samples' prior emergency experiences, the following issues need to be taken into consideration. First of all, the general population sample was only asked if they had experienced a fire, a flood, or a terrorist attack. As a possible consequence, the general public sample might contain some survivors of other types of emergency event. Moreover, an exact number of prior incidents of one kind cannot be determined, it can only be stated how many different types of emergencies the participant experienced; therefore, no statements can be made here about how the amount of prior experience might affect risk perception.

Furthermore, it needs to be noted that the location for experiencing the emergency event was not specified in the question. Concerning this matter, it is important to note that regional differences due to physical conditions are very important especially with respect to floods and earthquakes (Plapp and Werner 2004). Therefore, it is possible that people in the samples estimated their own risk not only with respect to their place of residence but also with respect to other countries (e.g. while traveling), and those other countries could have higher objective risks associated with certain incidents. Higher perceived risk might, therefore, be more appropriate in some cases.

It also needs to be taken into account that it is not known how participants interpreted the question and especially the phrase *will become a victim* in the risk-perception question. It might be possible that survivors of events and participants

with no prior emergency experience interpreted this phrase differently. Survivors might have answered with respect to simply experiencing such an event, since they already had an experience, whereas the general public sample might have interpreted the term *victim* with respect to actually being killed in such an event. Furthermore, a selection bias might be present since there is the possibility that people with an especially high level of perceived risk took part in the BeSeCu study in order to support research regarding emergency events. If one perceives a very high likelihood of becoming a victim again in the future, one might want to take an active role to improve and enhance knowledge regarding these incidents. If, on the other hand, someone has experienced an event but still evaluates the future risks as very low, one might not be as motivated to participate, since there is no obvious direct future worth in doing so for them personally.

Conclusion

In conclusion, this study showed that emergency experiences increase perceived risk, for the experienced event in particular. Past research usually focused on a specific event (i.e. one specific fire event or one specific flood); therefore, a generalization of results might be difficult since the results might be due to the specific characteristics of the one event investigated. Since this study included not just one fire incident or one flood, the findings might be more generalizable. It remains unclear if these changes persist over time and how other factors like incident severity moderate these changes. This study also demonstrated that gender is an important factor that moderates the accuracy of risk estimations. Concerning preparedness and especially safety communication it might be preferable to adapt strategies in order to address specific populations and specific types of hazards. In the general population sample, men underestimated their traffic and fire risk; therefore, safety campaigns could target men in order to achieve improvements, since women already have a more realistic risk perception. For future research, it is preferable to use even more subgroup-specific risk calculations, e.g. for different age groups or different road users, in order to investigate the possible gap between perceived and objective risk.

Acknowledgement

The authors acknowledge the cooperation of their project partners in the project BeSeCu (contract 218324) which is funded under the European Union Framework 7 Security initiative: Ernst-Moritz-Arndt University Greifswald, Department of Health and Prevention, Germany (project co-ordinator); University of Greenwich, FSEG, UK; Institute of Public Security of Catalunya, Spain; Hamburg Fire and Emergency Service Academy, Germany; MTO Säkerhet AB, Sweden; Prague Psychiatric Centre, Czech Republic; Main School of Fire Service, Poland; Hamburg Fire and Emergency Service Academy, Germany and Association of Emergency Ambulance Physicians, Turkey; University of Bologna, Italy; in undertaking this work and in allowing the project findings to be published.

References

- Alm, C., and E. Lindberg. 2000. *Perceived Risk, Feelings of Safety and Worry Associated with Different Travel Modes*. Stockholm: Kommunikationsforskningsberedningen.
- Andersson, H. 2011. "Perception of Own Death Risk: An Assessment of Road-traffic Mortality Risk." *Risk Analysis* 31 (7): 1069–1082. doi:10.1111/j.1539-6924.2011.01583.x.

- Armas, I. 2006. "Earthquake Risk Perception in Bucharest, Romania." *Risk Analysis* 26 (5): 1223–1234. doi:10.1111/j.1539-6924.2006.00810.x.
- Barnett, J., and G. M. Breakwell. 2001. "Risk Perception and Experience: Hazard Personality Profiles of Individual Differences." *Risk Analysis* 21 (1): 171–178. doi:10.1111/0272-4332.211099.
- AQ4 10 Bastide, S., J.-P. Moatti, J.-P. Pages, and F. Fagnani. 1989. "Risk Perception and Social Acceptability of Technologies: The French Case." *Risk Analysis* 9 (2): 215–223.
- AQ5 10 Brushlinsky, N. N., J. R. Hall, S. V. Sokolov, and P. Sokolov. 2008. *World Fire Statistics: Centre of Fire Statistics*. Quincy: International Association of Fire and Rescue Services - Center of Fire Statistics.
- 15 Cohen, M., J. Etner, and M. Jeleva. 2007. "Dynamic Decision Making When Risk Perception Depends on Past Experience." *Theory and Decision* 64 (2–3): 173–192. doi:10.1007/s11238-007-9061-3.
- AQ6 15 Destatis. 2011. *Statistical Yearbook*. Paderborn: Bonifatius GmbH, Druck-Buch-Verlag.
- AQ7 20 Deutscher Feuerwehrverband e.V. 2009. *Feuerwehr-Jahrbuch* [Fire Brigade Yearbook]. Bonn: DFV Medien GmbH.
- 20 Eisenman, D. P., D. Glik, M. Ong, Q. Zhou, Ch.-H. Tseng, A. Long, J. Fielding, and St. Asch. 2009. "Terrorism-related Fear and Avoidance Behavior in a Multiethnic Urban Population." *American Journal of Public Health* 99 (1): 168–174. doi:10.2105/AJPH.2007.124206.
- AQ8 25 Fischhoff, B. 1995. "Risk Perception and Communication Unplugged: Twenty Years of Progress." *Risk Analysis* 15 (2): 137–145. doi:10.1111/j.1539-6924.1995.tb00308.x.
- 25 Freudenburg, W. R. 1988. "Perceived Risk, Real Risk: Social Science and the Art of Probabilistic Risk Assessment." *Science* 242 (4875): 44–49. doi:10.1126/science.3175635.
- 30 Grabka, M. M., and J. R. Frick. 2008. "Schrumpfende Mittelschicht – Anzeichen einer dauerhaften Polarisierung der verfügbaren Einkommen ?[The Shrinking German Middle Class: Signs of Long-Term Polarization in Disposable Income?]." *Wochenbericht DIW Berlin* 10: 101–116.
- Gierlach, E., E. B. Bradley, and L. E. Beutler. 2010. "Cross-cultural Differences in Risk Perceptions of Disasters." *Risk Analysis* 30 (10): 1539–1549. doi:10.1111/j.1539-6924.2010.01451.x.
- AQ9 35 Gow, K., F. Pritchard, and D. Chant. 2008. How Close do You have to be to Learn the Lesson? Fire Burns! *The Australian Journal of Disaster and Trauma Studies* 2.
- 35 Gregory, R., and R. Mendelsohn. 1993. "Perceived Risk, Dread, and Benefits." *Risk Analysis* 13 (3): 259–264. doi:10.1111/j.1539-6924.1993.tb01077.x.
- 40 Hakes, J. K., and W. K. Viscusi. 2004. "Dead Reckoning: Demographic Determinants of the Accuracy of Mortality Risk Perceptions." *Risk Analysis* 24 (3): 651–664. doi:10.1111/j.0272-4332.2004.00465.x.
- 40 Halpern-Felsher, B. L., S. G. Millstein, J. M. Ellen, N. E. Adler, J. M. Tschann, and M. Biehl. 2001. "The Role of Behavioral Experience in Judging Risks." *Health Psychology* 20 (2): 120–126. doi:10.1037/0278-6133.20.2.120.
- 45 Helweg-Larsen, M. 1999. "(The Lack of) Optimistic Biases in Response to the 1994 Northridge Earthquake: The Role of Personal Experience." *Basic and Applied Social Psychology* 21 (2): 119–129. doi:10.1207/S15324834BA210204.
- 50 Ho, M.-C., D. Shaw, S. Lin, and Y.-C. Chiu. 2008. "How do Disaster Characteristics Influence Risk Perception?" *Risk Analysis* 28 (3): 635–643. doi:10.1111/j.1539-6924.2008.01040.x.
- 50 Horney, J. A., P. D. MacDonald, M. V. Willigen, P. R. Berke, and J. S. Kaufman. 2010. "Individual Actual or Perceived Property Flood Risk: Did IT Predict Evacuation from Hurricane Isabel in North Carolina, 2003?" *Risk Analysis* 30 (3): 501–511. doi:10.1111/j.1539-6924.2009.01341.x.
- 55 Kasapoglu, A., and E. Mehmet. 2004. "Comparative Behavioral Response to Future Earthquakes: The Cases of Turkey and USA." *Social Behavior and Personality* 32 (4): 373–382. doi:10.2224/sbp.2004.32.4.373.
- AQ1060 Kasperson, R. E., O. Renn, P. Slovic, H. S. Brown, J. Emel, R. Goble, J. X. Kasperson, and S. Ratick. 1988. "The Social Amplification of Risk: A Conceptual Framework." *Risk Analysis* 8 (2): 177–187. doi:10.1111/j.1539-6924.1988.tb01168.x.

- Kellens, W., R. Zaalberg, T. Neutens, W. Vanneuville, and P. D. Maeyer. 2011. "An Analysis of the Public Perception of Flood Risk on the Belgian Coast." *Risk Analysis* 31 (7): 1055–1068. doi:10.1111/j.1539-6924.2010.01571.x.
- Knuth, D., D. Kehl, E. Galea, L. Hulse, J. Sans, L. Valles, M. Roiha, et al. 2013. "BeSeCu-S – A Self-report Instrument for Emergency Survivors." *Journal of Risk Research*. 5
doi:10.1080/13669877.2013.815649.
- Knuth, D., D. Kehl, and S. Schmidt. 2013. "Development of Field Study Instruments BeSeCu-S and BeSeCu-FR." In *Behaviour-Security-Culture. Human Behaviour in Emergencies and Disasters: A Cross-cultural Investigation*, edited by S. Schmidt and E. Galea, 60–69. Lengerich: Papst Science. 10
- Krasovskaia, I., L. Gottschalk, N. R. Sealhun, and H. Berg. 2001. "Perception of the Risk of Flooding: The Case of the 1995 Flood in Norway." *Hydrological Sciences Journal* 46 (6): 855–868. doi:10.1080/02626660109492881.
- Lee, J. E. C., and L. Lemyre. 2009. "A Social-cognitive Perspective of Terrorism Risk Perception and Individual Response in Canada." *Risk Analysis* 29 (9): 1265–1280. doi:10.1111/j.1539-6924.2009.01264.x. 15
- Lee, J. E. C., L. Lemyre, and D. Krewski. 2010. "A Multi-method, Multi-hazard Approach to Explore the Uniqueness of Terrorism Risk Perceptions and Worry." *Journal of Applied Social Psychology* 40 (1): 241–272. doi:10.1111/j.1559-1816.2009.00572.x.
- Lichtenstein, S., P. Slovic, B. Fischhoff, M. Layman, and B. Combs. 1978. "Judged Frequency of Lethal Events." *Journal of Experimental Psychology* 4 (6): 551–578. doi:10.1037/0278-7393.4.6.551. 20
- Lindell, M. K., and S. N. Hwang. 2008. "Households' Perceived Personal Risk and Responses in a Multihazard Environment." *Risk Analysis* 28 (2): 539–556. doi:10.1111/j.1539-6924.2008.01032.x. 25
- Loewenstein, G., and J. Mather. 1990. "Dynamic Processes in Risk Perception." *Journal of Risk and Uncertainty* 3 (2): 155–175. doi:10.1007/BF00056370.
- Miceli, R., I. Sotgiu, and M. Settanni. 2008. "Disaster Preparedness and Perception of Flood Risk: A Study in an Alpine Valley in Italy." *Journal of Environmental Psychology* 28 (2): 164–173. doi:10.1016/j.jenvp.2007.10.006. 30
- National Consortium for the Study of Terrorism and Responses to Terrorism. 2011. *The Global Terrorism*. Accessed August 8, 2012. http://www.start.umd.edu/gtd/search/Results.aspx?chart=injuries&casualties_type=&casualties_max=&country=75&count=100
- Plapp, T., and U. Werner. 2004. "Understanding Risk Perception from Natural Hazards: Examples from Germany." Paper Presented at the RISK21 – Coping with Risks due to Natural Hazards in the 21st Century, Monte Verità, Switzerland. 35
- Schmidt, S., and E. Galea. 2013. *Behaviour - Security - Culture (BeSeCu): Human Behaviour in Emergencies and Disasters: A Cross-cultural Investigation*. Pabst: Wolfgang Science.
- Siegrist, M., and H. Gutscher. 2006. "Flooding Risks: A Comparison of Lay People's Perceptions and Expert's Assessments in Switzerland." *Risk Analysis* 26 (4): 971–979. doi:10.1111/j.1539-6924.2006.00792.x. 40
- Sjöberg, L. 1999. "Risk Perception by the Public and by Experts: A Dilemma in Risk Management." *Human Ecology Review* 6 (2): 1–8.
- Sjöberg, L. 2000. "Factors in Risk Perception." *Risk Analysis* 20 (1): 1–11. doi:10.1111/0272-4332.00001. 45
- Slovic, P. 1987. "Perception of Risk." *Science* 236 (4799): 280–285.
- Slovic, P. 1999. "Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-assessment Battlefield." *Risk Analysis* 19 (4): 689–701. doi:10.1111/j.1539-6924.1999.tb00439.x.
- Slovic, P., B. Fischhoff, and S. Lichtenstein. 1979. "Facts and Fears – Understanding Perceived Risk." *Policy and Practice in Health and Safety* 3: 65–102. 50
- Slovic, P., B. Fischhoff, and S. Lichtenstein. 1982. "Why Study Risk Perception?" *Risk Analysis* 2 (2): 83–93. doi:10.1111/j.1539-6924.1982.tb01369.x.
- Terpstra, T. 2011. "Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behavior." *Risk Analysis* 31 (10): 1658–1675. doi:10.1111/j.1539-6924.2011.01616.x. 55
- Turvey, C. G., B. Onyango, C. Cuite, and W. K. Hallman. 2010. "Risk, Fear, Bird Flu and Terrorists: A Study of Risk Perceptions and Economics." *The Journal of Socio-Economics* 39 (1): 1–10. doi:10.1016/j.soc.2009.08.008.

- 5 Tversky, A., and D. Kahneman. 1973. "Availability: A Heuristic for Judging Frequency and Probability." *Cognitive Psychology* 5 (2): 207–232. doi:10.1016/0010-0285(73)90033-9.
- Université Catholique de Louvain. 2012. *EM-DAT: The OFDA/CRED International Disaster Database*. Belgium: Brussels.
- Vastfjall, D., E. Peters, and P. Slovic. 2008. "Affect, Risk Perception and Future Optimism after the Tsunami Disaster." *Judgment and Decision Making Journal* 3 (1): 64–72.
- 10 Viscusi, W. K., and R. J. Zeckhauser. 2006. "National Survey Evidence on Disasters and Relief: Risk Beliefs, Self-interest, and Compassion." *Journal of Risk and Uncertainty* 33 (1–2): 13–36. doi:10.1007/s11166-006-0169-6.
- Visschers, V. H., and M. Siegrist. 2008. "Exploring the Triangular Relationship Between Trust, Affect, and Risk Perception: A Review of the Literature." *Risk Management* 10 (3): 156–167. doi:10.1057/rm.2008.1.
- 15 Yang, J., C. Peek-Asa, V. Allareddy, C. Zwerling, and J. Lundell. 2006. "Perceived Risk of Home Fire and Escape Plans in Rural Households." *American Journal of Preventive Medicine* 30 (1): 7–12. doi:10.1016/j.amepre.2005.08.045.

Anhang D: Studie 4

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2013). Perievent distress during fires - The impact of perceived emergency knowledge. *Journal of Environmental Psychology*, 34, 10–17. doi: <http://dx.doi.org/10.1016/j.jenvp.2012.12.002>



Perievent distress during fires – The impact of perceived emergency knowledge

Daniela Knuth^{a,*}, Doris Kehl^a, Lynn Hulse^b, Silke Schmidt^a

^aErnst-Moritz-Arndt-University Greifswald, Institute of Psychology, Department of Health and Prevention, Robert-Blum-Str. 13, D-17487 Greifswald, Germany

^bUniversity of Greenwich, UK

ARTICLE INFO

Article history:

Available online 21 December 2012

Keywords:

Emergency

Fire

Emergency prevention

Emergency knowledge

Distress

ABSTRACT

Emotional distress during fire situations and other emergencies has been found to be an important factor in predicting posttraumatic stress symptoms. Little research has been done concerning the predictors of peri-event emotional distress itself and its related factors. The present study investigated the predictive power of pre- and peri-event factors on peri-event emotional distress in a European convenience sample of 574 domestic fire survivors. In addition to peri-event emotional distress, the increase in distress due to the fire (i.e. fire-induced emotional distress) was investigated. It was found that fire-induced emotional distress could be predicted by the amount of prior perceived emergency knowledge, perceived time pressure, perceived threat, panic attack symptoms and education. Results of a path analysis revealed perceived emergency knowledge as the most important factor in reducing stress caused by the fire. Possible differences between perceived and actual emergency knowledge and their implications for training are discussed.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

Emergency situations such as fires demand that various decisions be made, usually in a short period of time. The situations tend to be considered as threatening and therefore induce emotions like worry or fear and can lead to distress, i.e. the negative dimension of stress (Lazarus & Folkman, 1984, p. 456; Proulx, 1993). The term distress in this paper refers to negative emotions like worry or fear, which are usually experienced during or immediately after threatening or harmful events (Birmes et al., 2005; Lazarus, 1993; Lazarus & Folkman, 1984, p. 456). Lazarus' stress theory considered the interpretation of an event as being more important than the event itself (Lazarus, 1993; Lazarus & Folkman, 1984, p. 456). It depends highly on the appraisal of the situation, which incorporates possible consequences as well as the perceived ability to handle demands, if the situation is considered stressful or not (Lazarus, 1993; Lazarus & Folkman, 1984, p. 456).

Stress is neither an abnormal nor a necessarily obstructive reaction in an emergency and it can motivate appropriate reactions (Paulsen, 1984; Proulx, 1993). However, post-event distress reactions have been predicted by peri-event reactions such as

emotional distress (Bernat, Ronfeldt, Calhoun, & Arias, 1998; Lawyer et al., 2006; Marmar, Weiss, Metzler, Ronfeldt, & Foreman, 1996; Nishi et al., 2012; Thomas, Saumier, & Brunet, 2012), as well as dissociation (Bernat et al., 1998; Bryant, Moulds, & Guthrie, 2000; Marmar, Weiss, & Metzler, 1996; Marmar, Weiss, Metzler, et al., 1996) and panic attack symptoms (Ahern, Galea, Resnick, & Vlahov, 2004; Bernat et al., 1998; Bryant & Panasetis, 2001; Pfefferbaum, Stuber, Galea, & Fairbrother, 2006) in various studies. A meta-analysis regarding the predictors of posttraumatic stress disorder (Ozer, Best, Lipsey, & Weiss, 2003) also revealed perceived life threat, peri-event emotions and peri-event dissociation to be important factors. It has been found that each of these constructs accounts for unique variance in PTSD symptoms (Birmes et al., 2005). There is little doubt then that these acute emotional reactions can affect possible later stress responses but research on how these peri-event distress reactions can be predicted or how they are related to one another is rare.

A study investigating acute stress disorder (Bryant & Panasetis, 2001) revealed more panic attack symptoms within the 28 days after the event (i.e. motor vehicle accident or nonsexual assault) in samples with a clinical or subclinical acute stress disorder. In a sample of New York City residents directly and indirectly affected by 9/11, the pre-event factors female gender, age (25–34 years and 45–54 years), experiencing one or more lifetime stressors in the past 12 months as well as being divorced or never married, were

* Corresponding author. Tel.: +49 (0)3834 86 3808; fax: +49 (0)3834 86 3801.
E-mail address: daniela.knuth@uni-greifswald.de (D. Knuth).

among factors significantly associated with experiencing more emotional reactions (i.e. fear of dying, helplessness, horror) during the event (Lawyer et al., 2006). It must be noted that emotional reactions were assessed with only three yes/no questions rather than with an intensity rating as suggested in previous studies (Bovin & Marx, 2011) and it remains unclear what other lifetime stressors were included and why these particular age groups were prone to more emotional reactions during the attacks (Lawyer et al., 2006). Nevertheless, age, as well as female gender and income, were found in another study to have a negative relationship with acute stress reactions (Benight & Harper, 2002). This study also revealed that the perceived ability to cope with environmental demands may reduce not only acute distress induced by floods and fires but also long-term psychological distress, confirming similar findings revealed earlier with hurricane survivors (Benight et al., 1999). Further pre-event factors that have been found to increase distress were the relationship status *single* (Taylor et al., 2012) and intermediate education level of women (compared to high education level; Ahnquist, Wamala, & Lindström, 2010). Lower trust in health-care services was also related to greater psychological distress (Ahnquist et al., 2010).

A study with professional rescue workers (Marmar, Weiss, Metzler, et al., 1996) revealed that workers who felt less prepared by prior training for a critical incident were also those who reported higher levels of peri-event distress and perceived threat during the event and were more likely to display greater distress up to four years after the event. In a study with earthquake survivors, a positive relationship between perceived threat and general distress was found as well as negative relationships between perceived control and distress and between self-efficacy and distress (Sumer, Karanci, Berument, & Gunes, 2005). Another recent path analysis, involving a sample of athletes engaging in a competition, also revealed a positive relationship between threat and unpleasant emotions as well as a negative relationship between controllability and threat (Nicholls, Polman, & Levy, 2012).

To sum up, it has been found that pre-event socio-demographic factors like gender and age may influence peri-event distress. The peri-event factors perceived threat and panic attack symptoms have been positively associated with peri- as well as post-event distress. Moreover, distress during an event has been negatively associated with the pre-event factor emergency training and the peri-event perceived ability to handle a situation. The studies cited here tended to look at the relationships of interest in isolation, therefore interactions remain unclear. Furthermore, the issues were examined in a variety of settings, ranging from stressful but non-emergency scenarios, to emergencies such as crimes against the person, through to large-scale disasters. The setting of interest to the current study was a fire in the home as this is a stressful situation that poses a serious threat to lives and well-being and, unlike emergencies such as floods or earthquakes, can and does happen anywhere. These fires are therefore a concern to all sections of the public, all over the world. It remains to be seen whether the relationships involving distress observed in previous studies will be replicated in this kind of setting.

The aim of this study is to investigate the predictive power of pre- and peri-event factors for peri-event distress in domestic fire events. Not only will already revealed factors be studied but also further factors that might influence stress reactions. In this context, the total amount of distress will be investigated as well as the amount of distress that is due only to the emergency situation itself (i.e. fire-induced distress). As a second goal, the relationships between revealed predictors for fire-induced distress are investigated more closely for their total, direct and indirect effects on peri-event emotional distress. In line with the previous literature it is hypothesized that:

- 1) Perceived emergency knowledge (i.e. knowledge participants perceived themselves to have gained from emergency training and other relevant sources) and the ability to handle the situation will reduce emotional distress during a fire. Perceived threat, female gender and panic attack symptoms during the situation will increase emotional distress.
- 2) A positive relationship will be detected between perceived emergency knowledge and the ability to handle the situation, as well as between perceived threat, panic attack symptoms and fire-induced distress.
- 3) Additionally, it is hypothesized that perceived emergency knowledge, as well as increasing the ability to handle the situation, will reduce the perception of threat.

2. Method

2.1. Participants

A sample of 574 domestic fire survivors from seven different countries was drawn (i.e. Poland, Italy, Spain, Germany, Turkey, Czech Republic and Sweden) as part of the project BeSeCu (Behavior, Security and Culture), which was funded under the European Union Framework programme 7 – Security and Space. The main goal of the project was the exploration of human behavior in different crisis situations (Schmidt, Knuth, & Kehl, 2011). Participants were included if they gave their informed consent and met the following inclusion criteria: (1) had experienced a domestic fire not before 1999 (i.e. not longer than 11 years ago); (2) the emergency services were involved; and (3) participants were at least 18 years of age. Criterion (1) was chosen in order to include survivors of the Izmir earthquake of 1999 in the overall project. Furthermore, research regarding memory biases has found that memories are less biased in children at the age of seven and older (Bauer, Burch, Scholin, & Güler, 2007; Cordón, Pipe, Sayfan, Melinder, & Goodman, 2004; Pillemer, 1998; Rubin, 2000) and since participants had to currently be at least 18 years of age, that meant our sample only included participants who were at least seven at the time of the incident. The mean age of the sample was 42.13 years (SD = 15.85 years) with a range of 18–96 years. On average, the incidents happened 2.38 years (SD = 2.87 years; median = 1.06 years) before the survey was carried out. Further sample details are displayed in Table 1.

2.2. Measures

Participants were asked to complete a standardized instrument, the BeSeCu-S, which was designed on the basis of a detailed literature review, expert consultations, cross-cultural focus groups and interviews with survivors (Freitag, Grimm, & Schmidt, 2011) as well as a pilot test (Grimm, Hulse, & Schmidt, 2012). The questionnaire was available online and in a paper and pencil version. Both administration types were identical with respect to layout and response styles across all languages. Among the 574 survivors, 80% filled out a paper and pencil questionnaire and 20% the online version. A 5-point Likert scale ranging from 1 to 5 (1 = not at all, 2 = a little bit, 3 = moderately, 4 = quite a bit, 5 = extremely) was adopted from the Impact of Event Scale – Revised (Weiss & Marmar, 1996) and used for all items of the scales (unless stated otherwise), since translated versions already existed in the languages of participating countries.

Factors identified in previous studies were measured in the following ways. Perceived emergency knowledge was assessed with the seven items of the Emergency Prevention Knowledge Scale (EPKS). The scale was introduced by the following question:

Table 1
Socio-demographic characteristics of the sample ($n = 574$) with respect to nationality.

	Total		Czech R.		Germany		Italy		Poland		Spain		Sweden		Turkey		Migrant		
	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	
Gender ^a																			
Female	305	54.3	49	68.1	66	58.9	24	60.0	51	53.1	16	44.4	31	56.4	19	28.4	49	58.3	
Male	257	45.7	23	31.9	46	41.1	16	40.0	45	46.9	20	55.6	24	43.6	48	71.6	35	41.7	
In a relationship ^b	368	65.6	44	61.1	72	64.3	29	72.5	67	70.5	25	69.4	28	50.9	51	75.0	52	62.7	
Low education ^c	77	13.7	11	15.3	9	8.0	2	5.1	5	5.3	14	38.9	11	20.0	15	21.4	10	12.0	
Medium education ^c	81	14.4	16	22.2	26	23.2	8	20.5	2	2.1	5	13.9	1	1.8	8	11.4	15	18.1	
High education ^c	404	71.9	45	62.5	77	68.8	29	74.4	88	92.6	17	47.2	43	78.2	47	67.1	58	69.9	
Employed ^d	456	80.6	54	75.0	93	83.0	37	92.5	76	79.2	27	75.0	35	63.6	68	95.8	66	78.6	
Income <70% ^e	209	39.0	37	51.4	42	39.3	23	63.9	34	38.2	7	24.1	11	20.4	23	35.4	32	38.1	
70% \geq $x \leq$ 150% ^e	227	42.4	26	36.1	44	41.1	12	33.3	50	56.2	12	41.4	23	42.6	24	36.9	36	42.9	
Income >150% ^e	100	18.7	9	12.5	21	19.6	1	2.8	5	5.6	10	34.5	20	37.0	18	27.7	16	19.0	

Note. Missing: ^a = 2.1%, ^b = 2.3%, ^c = 2.1%, ^d = 1.4%, ^e = 6.6%; low education = no or lowest formal qualification attainable; medium education = intermediary secondary education; high education = higher secondary education or university degree.

Before the incident occurred, what knowledge did you have that would be of use in an emergency? Participants then rated the following items on the aforementioned 5-point Likert scale: I had professional knowledge, gained from working for the emergency services; I had first aid knowledge, gained from a first aid course; I had fire safety knowledge, gained from being a warden/fire safety officer; I had taken part in fire drills at school; I had taken part in fire drills at work; I had read safety notices/evacuation plans in public places, such as in hotel rooms, train carriages, etc. and I had thought about what would happen if an emergency occurred in such a location and had prepared my own evacuation plan. Internal reliability (Cronbach's α) for the EPKS in this sample was 0.82. The perceived ability to deal with the situation was assessed with the following question: When you realized you were in an emergency situation, did you think you were able to deal with the situation? Participants rated their ability on the aforementioned 5-point Likert scale ranging from 1 (not at all) to 5 (extremely).

The subjective evaluation of threat was assessed with the Perceived Threat Scale (PTS) which consisted of the following two items, which were also rated on the aforementioned 5-point Likert scale: When you realized you were in an emergency situation, did you think your own life was in danger? and When you realized you were in an emergency situation, did you think the lives of your family/friends were in danger? Internal reliability (Cronbach's α) for the PTS in this sample was 0.77.

Possible panic-like responses were assessed with a question about the presence of the symptoms (i.e. fast heartbeat, sweating, trembling/shaking, shortness of breath, feeling of choking, chest pain or discomfort, nausea or abdominal distress, feeling dizzy, feelings of unreality or being detached from oneself, fear of losing control or going crazy, fear of dying, numbness or tingling sensations, chills or hot flushes) included in the DSM-IV (American Psychiatric Association, 1994) criteria for a panic attack.

Emotional distress was assessed with the five items of the Emotional Distress Scale (EDS) with respect to different stages of the events (before the event started and when realizing that an emergency was occurring). Participants were asked: [At the particular stage], what were your feelings? Participants rated their emotional distress with respect to the following items on the aforementioned 5-point Likert scale: I was nervous, I was scared, I was upset, I felt stress and I was calm (reverse coding). Internal reliability (Cronbach's α) for the EDS at realization in this sample was 0.87.

Extra factors, assessed in the BeSeCu-S, were considered relevant to the analysis. First were further pre-event socio-demographic factors such as the participant's relationship status, education and income. Second were two other pre-event factors, this time relating to emergencies in general. Emergency-related

trust was assessed with the Emergency Assistance Trust Scale (EATS), which consisted of seven items and was introduced by the following question: Before the incident occurred, to what extent did you believe you could rely on the following to assist you in an emergency? Participants were asked to rate their trust with respect to the following items: Family/Friends; Neighbors; Strangers; Medical service; Police; Fire service and Local authorities. Internal reliability (Cronbach's α) for the EATS in this sample was 0.76. Prior emergency experience was assessed by asking: Before the incident occurred, had you ever experienced any of the following incidents? People were then asked to indicate each incident they had already experienced (yes = 1, no = 0). The following answer options were possible: a fire in a home; an earthquake; a terrorist attack; a fire in a public building or a flood. Participants reported a mean sum of prior experience of 0.54 incidents (SD = 0.72; median = 0.00). Finally, four extra peri-event factors were examined: (1) interpretation of the situation (correct = 1, wrong = 2); (2) perceived time pressure, assessed with the question: Did you feel pressure to act fast (e.g. felt the situation could worsen at any moment)? (yes = 1, no = 2); (3) Mode of behavioral reaction (automatic = 1, rational = 2); and (4) whether further information was sought (yes = 1, no = 0).

2.3. Data analysis

Descriptive statistics were calculated and the mean scores for the EATS, EPKS, EDS, PTS and the ability to deal with the situation were used for analyses if at least 75% of the items were answered. Three hierarchical multiple regression analyses were performed in order to reveal and compare predictors at a baseline level before the event started, at the time of realization and for fire-induced distress only (i.e. distress at time of realization minus distress before the event). To prevent issues relating to recall biases or testing across different countries from confounding results, the first two models of each regression analysis included the control factors time since event (Step 1) and country of citizenship (plus migrant status; Step 2). For the country factor, effect codification was used in order to display the differences with respect to the grand mean. The third model (Step 3) included all pre-event socio-demographic factors of interest (i.e. gender, age, relationship status, education and income). In the fourth model (Step 4) pre-event factors related to emergencies in general were included (i.e. emergency assistance trust, perceived emergency knowledge and prior emergency experience). The fifth model (Step 5) included cognitive and behavioral factors at the time of realization (i.e. interpretation of event, time pressure, behavior, information seeking, perceived threat, panic symptoms, and ability to deal). A sixth model (Step 6) was added: it was believed that if participants self-evacuated or

were rescued from the building by professionals this would be indicative of event severity, which in turn could impact distress. Before entering categorical variables in the regression analysis, indicator variables were created using dummy codification. To check for multicollinearity the tolerance statistic and VIF values with respect to our model were checked. There was no collinearity since the tolerance statistics of each variable were greater than 0.1 and the VIF values were less than 10 (Field, 2009). These data analyses were performed using SPSS 19 (Windows). AMOS 19 was used for all path analytical and modeling procedures. Maximum likelihood method with estimation of means and intercepts was used to calculate parameters.

3. Results

3.1. Emotional distress

Descriptive characteristics of the selected predictors are presented in Table 2. Emotional distress at baseline level was lowest and the distress level rose by 1.61 on the 5-point Likert scale (i.e. fire-induced distress) to 3.32 at realization. The mean distress level was therefore moderate.

The results of the three regression analyses are displayed in Tables 3–5. Since the regression analyses included a broad number of different predictors, the tables present the adjusted R^2 values and the beta values of the final model and only include predictors that reached statistical significance. In total, only 6% of the variance in emotional distress at baseline level could be explained by the included factors. By contrast, 57% of the variance in emotional distress at the time of realization could be explained by the factors included in the analysis. In order to reveal factors that explicitly predicted the increase in distress, the third regression analysis was performed, predicting the difference between emotional distress at baseline and emotional distress at realization (i.e. fire-induced distress). Here, 24% of the total variance could be explained by the predictors. For the baseline level of distress, the factors education, number of panic attack symptoms, ability to deal with the situation as well as Polish citizenship were significant. The level of distress at realization was significantly predicted by gender, age, education, perceived emergency knowledge, perceived time pressure, perceived threat, the number of panic attack symptoms, the ability to deal with the situation as well as German and Polish citizenship. Looking at the fire-induced distress, only the factors education, perceived emergency knowledge, perceived time pressure, perceived threat, the number of panic attack symptoms and German citizenship were significant.

3.2. Modeling predictors of fire-induced distress

The revealed predictors for fire-induced distress were then tested in a proposed model. Analyses were repeated after eliminating pathways that were not significant. Fig. 1 illustrates the final

model with all significant paths between the factors. The proposed model revealed that perceived emergency knowledge had the largest total effect on fire-induced distress (see Table 6). The general fit indices indicated that the data fitted the model very well ($\chi^2[5, n = 574] = 5.63; p = 0.344; CFI = 1.0; RMSEA = 0.01 [0.00–0.06]$). Although German citizenship was a significant predictor of lower fire-induced distress it was not included in the final model since the aim of this study was to propose a general model comprising the pre- and peri-event factors of interest, and these factors were significant when controlling for country differences. Nevertheless, the results of a model including German citizenship as a factor revealed that German citizenship was related to higher perceived emergency knowledge, less perceived threat, less perceived time pressure and less fire-induced emotional distress.

4. Discussion

In this paper different predictors of emotional distress during domestic fire situations were explored with a series of regression analyses. In a second step a path analysis was done in order to investigate the relationships between the predictors of fire-induced distress. Results indicated that levels of emotional distress before the event were predicted by only a few factors. Distress at realization, on the other hand, was predicted by several factors. These included event-specific characteristics like time pressure, perceived threat, panic symptoms and the ability to deal with the situation. However, personal characteristics were also influential, e.g. women reported more distress at realization than did men, a negative relationship between age and distress was found here, and participants with medium education level were reportedly more distressed than highly educated participants. Perceived emergency knowledge was also revealed as a predictor, reducing emotional distress at realization. Fire-induced distress, and therefore the level of distress that was only due to the fire itself, was predicted largely by event-specific characteristics, with greater perceived threat, perceived time pressure and panic symptoms increasing fire-induced distress. Nonetheless, education played a part: participants with low education reported a lower increase in distress than did highly educated participants. Moreover, greater perceived emergency knowledge predicted a lower increase in distress. The low R -squared value of emotional distress at baseline suggests that most of the variation remains unexplained, which was not surprising since, apart from demographics, all predictors were incident-specific and should not impact the level of emotional distress before the event. However, the R -squared value of fire-induced emotional distress was also low, suggesting that there is still much variation left which is not explained by the factors included in this analysis.

The results support hypothesis (1) to some extent since female gender was a predictor for the total amount of emotional distress during realization but not for fire-induced emotional distress. Similarly, the ability to deal with the situation was a significant

Table 2
Descriptive characteristics of selected predictors and dependent variables ($n = 574$).

	<i>M</i>	<i>SD</i>	Median	Min	Max	Items	Rating	Miss %
Emotional distress (baseline)	1.68	0.95	1.20	1	5	5	1 = not at all to 5 = extreme	9.06
Emotional distress (realization)	3.32	1.14	3.40	1	5	5	1 = not at all to 5 = extreme	8.89
Fire-induced distress	1.61	1.30	1.60	–1.40	4.00	5	Realization – baseline stress	11.67
Panic attack symptoms	1.91	2.06	1.00	0	13	13	1 = yes, 0 = no	1.57
Ability to deal with the situation	2.93	1.18	3.00	1	5	1	1 = not at all to 5 = extreme	1.74
Perceived emergency knowledge	2.22	0.88	2.00	1	5	7	1 = not at all to 5 = extreme	4.53
Prior emergency experience	0.54	0.72	0.00	0	4	4	1 = yes, 0 = no	0
Perceived threat (realization)	2.66	1.26	2.50	1	5	2	1 = not at all to 5 = extreme	0.35

Note. Mean scores of the scale represent mean response to all items in the scale; Miss = missings.

Table 3
Regression analysis predicting mean emotional distress at baseline ($n = 390$).

	<i>B</i>	β	<i>t</i>	95% CI	
				Lower	Upper
Step 1: Control factors I	Adjusted $R^2 = 0.00$; $\Delta R^2 = 0.00$				
Step 2: Control factors II	Adjusted $R^2 = 0.01$; $\Delta R^2 = 0.03$				
Polish (Migrant = -1)	0.40	0.24	3.12**	0.15	0.65
Step 3: Pre-event factors I	Adjusted $R^2 = 0.03^*$; $\Delta R^2 = 0.03$				
Low education (High = ref.)	0.37	0.12	2.12*	0.03	0.72
Medium education (High = ref.)	0.29	0.11	1.99*	0.00	0.57
Step 4: Pre-event factors II	Adjusted $R^2 = 0.03^*$; $\Delta R^2 = 0.01$				
Step 5: Peri-event factors	Adjusted $R^2 = 0.06^{**}$; $\Delta R^2 = 0.04^*$				
Panic symptoms	0.07	0.14	2.46*	0.01	0.12
Ability to deal	-0.12	-0.15	-2.42*	-0.21	-0.02
Step 6: Event severity	Adjusted $R^2 = 0.06^{**}$; $\Delta R^2 = 0.01$				

Note. CI = confidence interval for *B*; ref. = reference category for categorical and dummy coded variables; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

predictor for the total amount of distress at realization but not for the increase due to the fire. Also, and in line with the stress theory of Lazarus (Lazarus, 1993; Lazarus & Folkman, 1984, p. 456), it was revealed that the perception of threat and the perceived ability to handle the situation were important factors for emotional distress, at least at realization. The more personal threat perceived, the higher the level of emotional distress in this sample, plus the higher the ability to handle the situation, the lower the distress level. With respect to the theories of appraisal (Lazarus & Folkman, 1984, p. 456), the emotional distress status investigated in this paper is related to the concept of primary appraisal (anticipation of possible threat and harm) and secondary appraisal (evaluation of possibility

Table 4
Regression analysis predicting mean emotional distress at realization ($n = 387$).

	<i>B</i>	β	<i>t</i>	95% CI	
				Lower	Upper
Step 1: Control factors I	Adjusted $R^2 = 0.00$; $\Delta R^2 = 0.00$				
Step 2: Control factors II	Adjusted $R^2 = 0.21^{***}$; $\Delta R^2 = 0.22^{***}$				
German (Migrant = -1)	-0.27	-0.14	-2.94**	-0.45	-0.09
Polish (Migrant = -1)	0.34	0.17	3.24**	0.13	0.54
Step 3: Pre-event factors I	Adjusted $R^2 = 0.29^{***}$; $\Delta R^2 = 0.09^{***}$				
Gender (male = ref.)	0.26	0.11	3.08**	0.09	0.42
Age (in years)	-0.01	-0.11	-2.87**	-0.01	-0.00
Medium education (High = ref.)	0.32	0.10	2.71**	0.09	0.55
Step 4: Pre-event factors II	Adjusted $R^2 = 0.33^{***}$; $\Delta R^2 = 0.04^{***}$				
Perceived emergency knowledge	-0.19	-0.14	-3.36***	-0.30	-0.08
Step 5: Peri-event factors	Adjusted $R^2 = 0.57^{***}$; $\Delta R^2 = 0.24^{***}$				
No time pressure (Yes = ref.)	-0.36	-0.12	-3.14**	-0.59	-0.14
Perceived threat	0.23	0.26	6.14***	0.16	0.31
Panic symptoms	0.13	0.23	6.10***	0.09	0.18
Ability to deal	-0.23	-0.23	-5.70***	-0.30	-0.15
Step 6: Event severity	Adjusted $R^2 = 0.57^{***}$; $\Delta R^2 = 0.00$				

Note. CI = confidence interval for *B*; ref. = reference category for categorical and dummy coded variables; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 5
Regression analysis predicting mean fire-induced emotional distress ($n = 384$).

	<i>B</i>	β	<i>t</i>	95% CI	
				Lower	Upper
Step 1: Control factors I	Adjusted $R^2 = 0.00$; $\Delta R^2 = 0.00$				
Step 2: Control factors II	Adjusted $R^2 = 0.09^{***}$; $\Delta R^2 = 0.10$				
German (Migrant = -1)	-0.29	-0.13	-2.03*	-0.57	-0.01
Step 3: Pre-event factors I	Adjusted $R^2 = 0.10^{***}$; $\Delta R^2 = 0.04^*$				
Low education (High = ref.)	-0.59	-0.13	-2.60**	-1.03	-0.14
Step 4: Pre-event factors II	Adjusted $R^2 = 0.15^{***}$; $\Delta R^2 = 0.05^{***}$				
Perceived emergency knowledge	-0.30	-0.19	-3.47***	-0.47	-0.13
Step 5: Peri-event factors	Adjusted $R^2 = 0.25^{***}$; $\Delta R^2 = 0.10^{***}$				
No time pressure (Yes = ref.)	-0.48	-0.14	-2.69**	-0.83	-0.13
Perceived threat	0.23	0.22	3.91***	0.11	0.34
Panic symptoms	0.07	0.10	2.00*	0.00	0.13
Step 6: Event severity	Adjusted $R^2 = 0.24^{***}$; $\Delta R^2 = 0.00$				

Note. CI = confidence interval for *B*; ref. = reference category for categorical and dummy coded variables; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

to respond to this threat). The importance of appraisal with respect to peri-event responses has also been supported in a model concerning the risk for PTSD symptoms (Bovin & Marx, 2011). In particular, the intensity of peri-event reactions was considered important in predicting later PTSD (Bovin & Marx, 2011).

Apart from the relationships between perceived emergency knowledge, perceived threat and the ability to deal with the situation, hypotheses (2) and (3) were supported by the results of the path analysis. Two newly revealed factors, perceived time pressure and education, were also included in the model. Perceived emergency knowledge had the largest effect with respect to reducing fire-induced distress and decreasing perceived time pressure. As suggested in a previous study (Bovin & Marx, 2011), peri-event factors do interact with each other. For example, perceived threat, panic symptoms and perceived time pressure did not only influence the increase in emotional distress but also each other. The total effect of education on fire-induced distress was not as strong as that of other factors.

The regression and path analysis results demonstrate the importance of preparation or perceived emergency knowledge in an emergency to reduce distress caused by the event. Although previous studies have highlighted that emergency training can improve behavioral responses in an emergency (Hwang, Duchossois, Garcia-Espana, & Durbin, 2006; Soffer, Goldberg, Avisar-Shohat, & Cohen, 2009) like calling the fire brigade as a first action or reacting more quickly and thereby reducing pre-evacuation times (Zhao, Lo, Zhang, & Liu, 2009), other studies (Proulx & Reid, 2006) did not find an improvement in evacuation behavior due to emergency training. It must be noted that these studies differ with respect to the evaluation of emergency knowledge and emergency behavior. It was stated that behavior improves with training (Hwang et al., 2006; Zhao et al., 2009) but knowledge might not (Hwang et al., 2006; Proulx & Reid, 2006). One possible question arises from these results and the present study: Is perceived knowledge more important in reducing distress than actual emergency knowledge? The present study investigated perceived emergency knowledge and illustrated its impact on peri-event emotional distress as well as on the emotional distress induced specifically by the emergency. This evaluation might differ

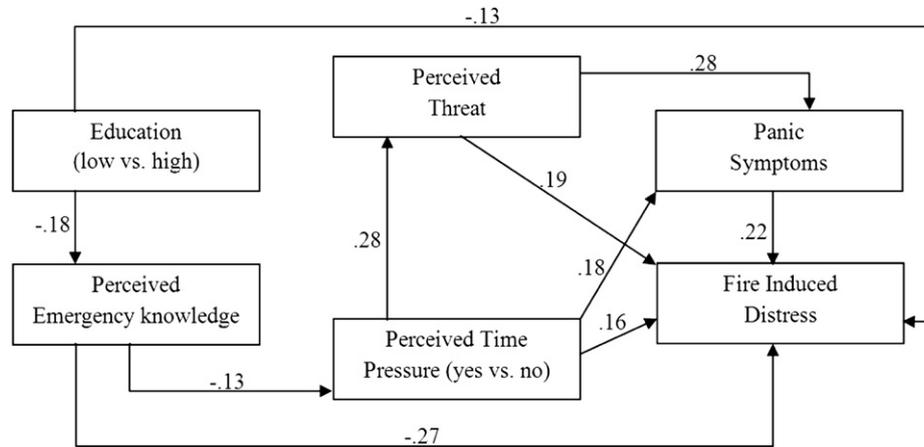


Fig. 1. Path analysis of fire-induced emotional distress.

from an actual knowledge query, which is often used in evaluation of trainings (Hwang et al., 2006; Soffer et al., 2009). The results of a fire intervention study with children (Hwang et al., 2006) indicated an improvement in correct emergency behavior but no differences in actual knowledge were found. Therefore it is important to investigate not only emergency knowledge but also perceived emergency knowledge which might increase by training.

The results in this study for an index of more general knowledge, i.e. education, were mixed. For baseline and realization distress, participants with lower education reported greater distress than more highly educated participants, whereas for fire-induced distress the opposite result was found. Participants with lower education reported a smaller increase in distress. A negative relationship between education and distress was previously reported with respect to general distress (Sumer et al., 2005), peri-event fear (Başoğlu, Salcıoğlu, & Livanou, 2002) and PTSD symptoms (Başoğlu et al., 2002; DiGrande et al., 2008; van der Velden, Kleber, Grievink, Olff, & Meewisse, 2006). Regarding the smaller increase in distress for participants with low education, it can be argued that these participants already reported higher levels of distress at baseline and therefore the increase was smaller since they were already at a higher distress level. It might also be possible that high education leads to a more immediate increase in distress, i.e. a quicker appreciation of the danger and consequences, whereas distress for participants with low education increases later in the course of the event and not at the stage of realization. A study concerning behavior in a fire (Zhao et al., 2009) has found that less educated participants more often tried to extinguish the fire themselves compared to higher educated participants. A possible delay in starting to evacuate due to these different actions might have crucial effects.

Some limitations need to be taken into consideration when looking at the present results. The BeSeCu-S questionnaire employs a retrospective self-report approach. Therefore although participants were asked to recall their perceived emergency

knowledge from the time before the event, the answers might be biased by the experience of the event itself, by the emotional distress they experienced, perhaps by social desirability or simply by forgetting over time. To control in part for this, time since the event was entered first into the regression analyses and at no point was significant. More importantly, memory for disasters (Rodríguez, Quarantelli, & Dynes, 2006) and for emotion-related events (Burke, Heuer, & Reisberg, 1992; Ritchey, Dolcos, & Cabeza, 2008) have been found to be durable. A further study, which investigated the reliability of delayed self-reports regarding experiences in a hurricane (Norris & Kaniasty, 1992), found that, in particular, reports of losses and preparedness remained stable when compared to the first reports made ten months earlier. Results of an experimental study also indicate that retrospective ratings of emotion are quite accurate (Barrett, 1997) and reports of peri-event responses during disaster events have been found to be consistent over time (Ouimette, Read, & Brown, 2005). To conclude then, it has been shown that survivors are quite able to remember a distressing event, even after a long period of time, although longitudinal studies covering longer periods of time are very rare.

Country of citizenship was a significant predictor in all three regressions. However, as with time since the event, this was entered early in the analysis in order to control for any effects. It must be noted that the country-specific samples might not be representative and were rather convenience sampled, which makes any comment about potential cultural differences or a generalization of findings difficult. In this context, a potential self-selection bias needs to be taken into account as well. It is possible that survivors who participated in the study might represent a subgroup of individuals with experience of less severe events. Survivors with severe traumatic experiences might have refused to participate to avoid reminders. On the other hand, survivors who considered the event as only minor or not serious enough might not have taken part in the study as well.

Table 6

Standardized effects of each predictor on other predictors and fire-induced distress.

	Education (low vs. high)	Perceived emergency knowledge	Time pressure	Perceived threat	Panic attack symptoms
Perceived emergency knowledge	−0.18 (−0.18/0)	0	0	0	0
Time pressure	0.02 (0/0.02)	−0.13 (−0.13/0)	0	0	0
Perceived threat	0.01 (0/0.01)	−0.04 (0/−0.04)	0.28 (0.28/0)	0	0
Panic attack symptoms	0.01 (0/0.01)	−0.03 (0/−0.03)	0.26 (0.18/0.08)	0.28 (0.28/0)	0
Fire-induced distress	−0.07 (−0.13/0.05)	−0.30 (−0.27/−0.03)	0.27 (0.16/0.11)	0.25 (0.19/0.06)	0.22 (0.22/0)

Note. Total standardized effects are presented first with direct/indirect effects in parentheses.

5. Conclusion, perspectives and possible impact

These results indicate that perceived emergency knowledge is an important factor which can help to reduce fire-induced distress. With respect to practitioners and safety trainers, it might also be important to survey perceived knowledge rather than just actual knowledge in order to investigate possible discrepancies between these two types of knowledge. Future research should try to apply longitudinal studies and investigate the effects of perceived and actual knowledge on emergency behavior and possible long-term consequences and test the present findings in other emergencies as well.

Acknowledgment

The paper was written by the authors on behalf of the BeSeCu-group. The project BeSeCu (contract no. 218324) is funded under the European Union Framework programme 7 – Security and Space. The authors acknowledge the collaboration of their project partners: Ernst-Moritz-Arndt University of Greifswald, Germany (Silke Schmidt – project co-ordinator, Daniela Knuth, Doris Kehl); Hamburg Fire and Emergency Service Academy, Germany (Frank Seidler and Eberhard Diebe); University of Greenwich UK (Ed Galea and Lynn Hulse); Institute of Public Security of Catalonia, Spain (Jordi Sans, Malin Roiha and Lola Valles); Prague Psychiatric Centre, Czech Republic (Marek Preiss, Marie Sotolarova, and Marketa Holubova); Man-Technology-Organisation (MTO-) Säkerhet AB, Sweden (Lena Kecklund and Sara Petterson); Main School of Fire Service, Poland (Jerzy Wolanin and Grzegorz Beltowski); Association of Emergency Ambulance Physicians, Turkey (Zeynep Baskaya and Turhan Sofuoglu); University of Bologna, Italy (Luca Pietrantonio and Elisa Saccinto); in undertaking this work and in allowing the project findings to be published.

References

Ahern, J., Galea, S., Resnick, H. S., & Vlahov, D. (2004). Television images and probable posttraumatic stress disorder after September 11. *The Journal of Nervous and Mental Disease*, 192(3), 217–226. <http://dx.doi.org/10.1097/01.nmd.0000116465.99830.ca>.

Ahnquist, J., Wamala, S. P., & Lindström, M. (2010). What has trust in the health-care system got to do with psychological distress? Analyses from the national Swedish survey of public health. *International Journal for Quality in Health Care*, 22(4), 250–258. <http://dx.doi.org/10.1093/intqhc/mzq024>.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC.

Barrett, L. F. (1997). The relationships among momentary emotion experiences, personality descriptions, and retrospective ratings of emotion. *Personality and Social Psychology Bulletin*, 23(10), 1100–1110. <http://dx.doi.org/10.1177/01461672972310010>.

Bauer, P. J., Burch, M. M., Scholin, S. E., & Güler, O. E. (2007). Using cue words to investigate the distribution of autobiographical memories in childhood. *Psychological Science*, 18(10), 910–916. <http://dx.doi.org/10.1111/j.1467-9280.2007.01999.x>.

Başoğlu, M., Salcıoğlu, E., & Livanou, M. (2002). Traumatic stress responses in earthquake survivors in Turkey. *Journal of Traumatic Stress*, 15(4), 269–276. <http://dx.doi.org/10.1023/A:1016241826589>.

Benight, C. C., & Harper, M. L. (2002). Coping self-efficacy perceptions as a mediator between acute stress response and long-term distress following natural disasters. *Journal of Traumatic Stress*, 15(3), 177–186. <http://dx.doi.org/10.1023/A:1015295025950>.

Benight, C. C., Ironson, G., Klebe, K., Carver, C. S., Wynnings, C., Burnett, K., et al. (1999). Conservation of resources and coping self-efficacy predicting distress following a natural disaster: A causal model analysis where the environment meets the mind. *Anxiety, Stress & Coping*, 12(2), 107–126. <http://dx.doi.org/10.1080/10615809908248325>.

Bernat, J. A., Ronfeldt, H. M., Calhoun, K. S., & Arias, I. (1998). Prevalence of traumatic events and peritraumatic predictors of posttraumatic stress symptoms in a nonclinical sample of college students. *Journal of Traumatic Stress*, 11(4), 645–664. <http://dx.doi.org/10.1023/A:1024485130934>.

Birmes, P. J., Brunet, Coppin-Calmes, D., Arbus, C., Coppin, D., Charlet, J.-P., et al. (2005). Symptoms of peritraumatic and acute traumatic stress among victims of an industrial disaster. *Psychiatric Services*, 56(1), 93–95. <http://dx.doi.org/10.1176/appi.ps.56.1.93>.

Bovin, M. J., & Marx, B. P. (2011). The importance of the peritraumatic experience in defining traumatic stress. *Psychological Bulletin*, 137(1), 47–67. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21090886>.

Bryant, R. A., Moulds, M. L., & Guthrie, R. M. (2000). Acute stress disorder scale: A self-report measure of acute stress disorder. *Psychological Assessment*, 12(1), 61–68. <http://dx.doi.org/10.1037/1040-3590.12.1.61>.

Bryant, R. A., & Panasetis, P. (2001). Panic symptoms during trauma and acute stress disorder. *Behaviour Research and Therapy*, 39(8), 961–966. [http://dx.doi.org/10.1016/S0005-7967\(00\)00086-3](http://dx.doi.org/10.1016/S0005-7967(00)00086-3).

Burke, A., Heuer, F., & Reisberg, D. (1992). Remembering emotional events. *Memory & Cognition*, 20(3), 277–290. <http://dx.doi.org/10.3758/BF03199665>.

Cordón, I. M., Pipe, M.-E., Sayfan, L., Melinder, A., & Goodman, G. S. (2004). Memory for traumatic experiences in early childhood. *Developmental Review*, 24(1), 101–132. <http://dx.doi.org/10.1016/j.dr.2003.09.003>.

DiGrande, L., Perrin, M. A., Thorpe, L. E., Thalji, L., Murphy, J., Wu, D., et al. (2008). Posttraumatic stress symptoms, PTSD, and risk factors among lower Manhattan residents 2–3 years after the September 11, 2001 terrorist attacks. *Journal of Traumatic Stress*, 21(3), 264–273. <http://dx.doi.org/10.1002/jts.20345>.

Field, A. P. (2009). *Discovering statistics using SPSS: (and sex and drugs and rock "n" roll)* (3rd ed.). London: Sage.

Freitag, S., Grimm, A., & Schmidt, S. (2011). Talking about traumatic events: A cross-cultural investigation. *Europe's Journal of Psychology*, 7(1), 40–61. <http://dx.doi.org/10.5964/ejop.v7i1.104>.

Grimm, A., Hulse, L., & Schmidt, S. (2012). Human responses to disasters: A pilot study on peritraumatic emotional and cognitive processing. *Europe's Journal of Psychology*, 8(1), 112–138. <http://dx.doi.org/10.5964/ejop.v8i1.303>.

Hwang, V., Duchossois, G. P., Garcia-Espana, J. F., & Durbin, D. R. (2006). Impact of a community based fire prevention intervention on fire safety knowledge and behavior in elementary school children. *Injury Prevention*, 12(5), 344–346. <http://dx.doi.org/10.1136/ip.2005.011197>.

Lawyer, S. R., Resnick, H. S., Galea, S., Ahern, J., Kilpatrick, D. G., & Vlahov, D. (2006). Predictors of peritraumatic reactions and PTSD following the September 11th terrorist attacks. *Psychiatry*, 69(2), 130–141. <http://dx.doi.org/10.1521/psyc.2006.69.2.130>.

Lazarus, R. S. (1993). From psychological stress to the emotions: A history of changing outlooks. *Annual Review of Psychology*, 44, 1–22. <http://dx.doi.org/10.1146/annurev.ps.44.020193.000245>.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*, Vol. 116. New York: Springer.

Marmar, C. R., Weiss, D. S., & Metzler, T. J. (1996). The peritraumatic dissociative experiences questionnaire. In J. P. Wilson, & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 144–167). New York: The Guilford Press.

Marmar, C. R., Weiss, D. S., Metzler, T. J., Ronfeldt, H. M., & Foreman, C. (1996). Stress responses of emergency services personnel to the Loma Prieta earthquake interstate 880 freeway collapse and control traumatic incidents. *Journal of Traumatic Stress*, 9(1), 63–85. <http://dx.doi.org/10.1002/jts.2490090107>.

Nicholls, A. R., Polman, R. C. J., & Levy, A. R. (2012). A path analysis of stress appraisals, emotions, coping, and performance satisfaction among athletes. *Psychology of Sport and Exercise*, 13(3), 263–270. <http://dx.doi.org/10.1016/j.psychsport.2011.12.003>.

Nishi, D., Koido, Y., Nakaya, N., Sone, T., Noguchi, H., Hamazaki, K., et al. (2012). Peritraumatic distress, watching television, and posttraumatic stress symptoms among rescue workers after the great east Japan earthquake. *PLoS ONE*, 7(4), e35248. Retrieved from <http://dx.doi.org/10.1371/journal.pone.0035248>.

Norris, F. H., & Kaniasty, K. (1992). Reliability of delayed self-reports in disaster research. *Journal of Traumatic Stress*, 5(4), 575–588. <http://dx.doi.org/10.1002/jts.2490050407>.

Ouimette, P., Read, J., & Brown, P. J. (2005). Consistency of retrospective reports of DSM-IV criterion A traumatic stressors among substance use disorder patients. *Journal of Traumatic Stress*, 18(1), 43–51. <http://dx.doi.org/10.1002/jts.20009>.

Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin*, 129(1), 52–73. <http://dx.doi.org/10.1037/0033-2909.129.1.52>.

Paulsen, R. L. (1984). Human behavior and fires: An introduction. *Fire Technology*, 20(2), 15–27. <http://dx.doi.org/10.1007/BF02384147>.

Pfefferbaum, B., Stuber, J., Galea, S., & Fairbrother, G. (2006). Panic reactions to terrorist attacks and probable posttraumatic stress disorder in adolescents. *Journal of Traumatic Stress*, 19(2), 217–228. <http://dx.doi.org/10.1002/jts.20118>.

Pillemer, D. B. (1998). What is remembered about early childhood events? *Clinical Psychology Review*, 18(8), 895–913. [http://dx.doi.org/10.1016/S0272-7358\(98\)00042-7](http://dx.doi.org/10.1016/S0272-7358(98)00042-7).

Proulx, G. (1993). A stress model for people facing a fire. *Journal of Environmental Psychology*, 13(2), 137–147. [http://dx.doi.org/10.1016/S0272-4944\(05\)80146-X](http://dx.doi.org/10.1016/S0272-4944(05)80146-X).

Proulx, G., & Reid, I. M. A. (2006). Occupant behavior and evacuation during the Chicago cook county administration building fire. *Journal of Fire Protection Engineering*, 16(4), 283–309. <http://dx.doi.org/10.1177/1042391506065951>.

Ritchey, M., Dolcos, F., & Cabeza, R. (2008). Role of amygdala connectivity in the persistence of emotional memories over time: An event-related fMRI investigation. *Cerebral Cortex*, 18(11), 2494–2504. <http://dx.doi.org/10.1093/cercor/bhm262>.

Rodriguez, H., Quarantelli, E. L., & Dynes, R. (2006). *Handbook of disaster research*. New York: Springer.

Rubin, D. C. (2000). The distribution of early childhood memories. *Memory*, 8(4), 265–269. <http://dx.doi.org/10.1080/096582100406810>.

Schmidt, S., Knuth, D., & Kehl, D. (2011). Human behavior in crisis situations: Results from a field study of fire fighters and survivors across different types of disaster

- situations. In W. Jaskótkowski, & P. Kepka (Eds.), *Emergency evacuation of people from buildings* (pp. 309–316). Warszawa: BEL Studio.
- Soffer, Y., Goldberg, A., Avisar-Shohat, G., & Cohen, R. (2009). The effect of different educational interventions on schoolchildren's knowledge of earthquake protective behaviour in Israel. *Disasters*, 34(1), 205–213. <http://dx.doi.org/10.1111/j.1467-7717.2009.01125.x>.
- Sumer, N., Karanci, A. N., Berument, S. K., & Gunes, H. (2005). Personal resources, coping self-efficacy, and quake exposure as predictors of psychological distress following the 1999 earthquake in Turkey. *Journal of Traumatic Stress*, 18(4), 331–342. <http://dx.doi.org/10.1002/jts.20032>.
- Taylor, A. W., Chittleborough, C., Gill, T. K., Winefield, H., Baum, F., Hiller, J. E., et al. (2012). Relationship of social factors including trust, control over life decisions, problems with transport and safety, to psychological distress in the community. *Social Psychiatry and Psychiatric Epidemiology*, 47(3), 465–473. <http://dx.doi.org/10.1007/s00127-011-0354-z>.
- Thomas, E., Saumier, D., & Brunet, A. (2012). Peritraumatic distress and the course of posttraumatic stress disorder symptoms: A meta-analysis. *Canadian Journal of Psychiatry*, 57(2), 122–129. Retrieved from. <http://search.ebscohost.com/login.aspx?direct=true&db=pbh&AN=73791904&site=ehost-live>.
- van der Velden, P. G., Kleber, R. J., Christiaan, B., Gersons, B. P. R., Marcelissen, F. G. H., Drogendijk, A. N., et al. (2006). The independent predictive value of peritraumatic dissociation for postdisaster intrusions, avoidance reactions, and PTSD symptom severity: A 4-year prospective study. *Journal of Traumatic Stress*, 19(4), 493–506. <http://dx.doi.org/10.1002/jts.20140>.
- Weiss, D. S., & Marmar, C. R. (1996). The impact of event scale – revised. In J. P. Wilson, & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399–411). New York: Guilford.
- Zhao, C. M., Lo, S. M., Zhang, S. P., & Liu, M. (2009). A post-fire survey on the pre-evacuation human behavior. *Fire Technology*, 45(1), 71–95. <http://dx.doi.org/10.1007/s10694-007-0040-6>.

Erklärung des Eigenanteils

Übersicht der Eigenanteile der Autorin an den vorgelegten wissenschaftlichen Arbeiten:

Studie 1: Knuth, D., , L., Sans, J., Vallès, L., Roiha, M., Seidler, F., Kehl, D., Galea, E., Hulse Diebe, E., Kecklund, L., Petterson, S., Wolanin, J., Beltowski, G., Preiss, M., Sotolárová, M., Holubová, M., Sofuoglu, T., Baskaya Sofuoglu, Z., Pietrantoni, L., Saccinto, E. & Schmidt, S. (2013).

Studienkonzeption/-design	Knuth
Erarbeitung der Fragestellung	Knuth
Datenerhebung	Knuth, Kehl, Galea, Hulse, Sans, Vallès, Roiha, Seidler, Diebe, Kecklund, Petterson, Wolanin, Beltowski, Preiss, Sotolárová, Holubová, Sofuoglu, Baskaya Sofuoglu, Pietrantoni, Saccinto, Schmidt
Datenanalyse	Knuth
Interpretation der Daten	Knuth
Erstellung des Manuskripts	Knuth, Kehl, Galea, Hulse, Sans, Vallès, Roiha, Seidler, Diebe, Kecklund, Petterson, Wolanin, Beltowski, Preiss, Sotolárová, Holubová, Sofuoglu, Baskaya Sofuoglu, Pietrantoni, Saccinto, Schmidt
Revision des Manuskripts	Knuth

Studie 2: Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (in press)

Studienkonzeption/-design	Knuth
Erarbeitung der Fragestellung	Knuth
Datenerhebung	Knuth, Kehl, Hulse, Schmidt
Datenanalyse	Knuth
Interpretation der Daten	Knuth
Erstellung des Manuskripts	Knuth, Kehl, Hulse, Schmidt
Revision des Manuskripts	Knuth

Studie 3: Knuth, D., Kehl, D., Hulse, L., Spangenberg, L., Brähler, E. & Schmidt, S. (in press)

Studienkonzeption/-design	Knuth
Erarbeitung der Fragestellung	Knuth
Datenerhebung	Knuth, Kehl, Hulse, Spangenberg, Brähler, Schmidt
Datenanalyse	Knuth
Interpretation der Daten	Knuth
Erstellung des Manuskripts	Knuth, Kehl, Hulse, Spangenberg, Brähler, Schmidt
Revision des Manuskripts	Knuth

Studie 4: Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2013)

Studienkonzeption/-design	Knuth
Erarbeitung der Fragestellung	Knuth
Datenerhebung	Knuth, Kehl, Hulse, Schmidt
Datenanalyse	Knuth
Interpretation der Daten	Knuth
Erstellung des Manuskripts	Knuth, Kehl, Hulse, Schmidt
Revision des Manuskripts	Knuth

Eigenständigkeitserklärung

Eidesstattliche Erklärung

Hiermit erkläre ich, dass diese Arbeit bisher von mir weder an der Mathematisch-Naturwissenschaftlichen Fakultät der Ernst-Moritz-Arndt-Universität Greifswald noch einer anderen wissenschaftlichen Einrichtung zum Zwecke der Promotion eingereicht wurde.

Ferner erkläre ich, dass ich diese Arbeit selbständig verfasst und keine anderen als die darin angegebenen Hilfsmittel und Hilfen benutzt und keine Textabschnitte eines Dritten ohne Kennzeichnung übernommen habe.

Greifswald, den

Ort, Datum

Unterschrift des Promovenden