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Risk, Hazards, and Crises in Research: What Risks Get Researched, Where, and How?

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This review article maps the shifts and trends in the risk literature regarding particular risk types across the past 30+ years. Not only does it address which hazards and risks receive scholarly attention, but also from which perspective. A similar review on crisis literature (Kuipers & Welsh, 2017) reported that on average only 14 percent of the articles in three crisis and disaster journals pertained explicitly to risk research. Does risk research perhaps pay more attention to crises than the other way around? Our multivariate regression analysis of the different types and themes reveals how some risk types are researched and discussed almost exclusively from a particular angle. Also, the large majority of articles from some perspectives only take a limited variety of risks into account. Mapping risk research reveals not only which topics and themes have received increasing or structural attention but also which ones, or which combination of risk types and perspectives, perhaps deserve more study than they currently receive.

KEY WORDS: literature review, risk research, hazards, crises

研究中的风险，灾害和危机：被研究的风险有哪些？研究地点和手段是什么？

本篇综述将过去三十多年间研究特别风险类型的风险文章所呈现的转变和趋势进行了编排。本文不仅研究了哪些灾害和风险受到了学术关注，同时还研究了这些学术关注的出发点有哪些。一项相似的危机文献综述 (Kuipers & Welsh, 2017) 显示，在以危机和灾害为主题的三种期刊中，平均而言仅有14%的文章与风险研究明显相关。风险研究有可能将更多关注聚焦于危机，还是相反？本文针对不同风险类型和主题所进行的多变量回归分析显示：一些风险类型如何在一个特定视角下被研究和探讨。同时，从某些观点来看，大多数文章仅考虑了部分风险种类。通过将风险研究进行编排，不仅能表明哪些主题受到了更多关注，同时还显示出哪些风险类型和观点(或二者的结合)有可能受到更多研究。

关键词： 文献综述，风险研究，灾害，危机

Riesgos, peligros y crisis en la investigación: ¿Qué riesgos se investigan, cómo y cuándo?

Este artículo de reseña mapea los cambios y las tendencias en la literatura de riesgo con respecto a tipos de riesgo particulares a través de los últimos 30 años y más. No solo aborda el tema de qué peligros y riesgos reciben atención académica, sino que también desde qué perspectiva. Una reseña

1 similar de la literatura de crisis (Kuipers y Welsh, 2017) reportó que en promedio solo 14 percent de
2 los artículos en tres revistas de crisis y desastre tenían que ver explícitamente con la investigación
3 de los riesgos. ¿Acaso la investigación de riesgos presta más atención a las crisis que al revés?
4 Nuestro análisis de regresión multivariable de los diferentes tipos y temas revela cómo algunos tipos
5 de riesgo se investigan y discuten casi exclusivamente desde un ángulo particular. También, una
6 gran mayoría de artículos de algunas perspectivas solo toman en cuenta una variedad limitada de
7 perspectivas. El mapeo de la investigación de riesgos revela no solo qué temas generales y específicos
8 han recibido una atención creciente o estructural, sino también cuáles, o qué combinación de tipos
9 de riesgos y perspectivas, tal vez merezcan más estudio del que reciben actualmente.

10 **PALABRAS CLAVES:** reseña literaria, investigación de riesgos, peligros, crisis

11 Introduction

12 The journal *Risk, Hazards and Crisis in Public Policy* (RHCPP) explicitly relates
13 risk and crises in its title and mission. Although risk and crisis form an intuitively
14 sensible combination, academic research shows a strong divide between the two.
15 Scholars either seem to study risks, or crises. The fact that crises imply that a risk
16 has materialized, and that many risks would be negligible if their potential
17 impact would not constitute a crisis, does not seem to result in much dialogue
18 between scholars from either side. This article aims to explore trends in the risk
19 literature and to identify the potential for synergy with crisis research.

20 Over the years, crisis research has moved from a focus on the emergency
21 management of accidents and disasters, to the “politics” of managing affairs,
22 social unrest and scandals that are marked by profound uncertainties regarding
23 risks and threats (Boin, 't Hart, Stern, & Sundelius, 2016; Gilbert, 2007). Risks,
24 particularly ignored or neglected ones in public policymaking, can provide fertile
25 ground for both large-scale accidents and political crises. In turn, the manifesta-
26 tion of extreme events with low probability and high impact significantly affect
27 policy decisions and the multi-year allocation of public resources for mitigating
28 and regulating risks. Vos (2000) showed how high-impact risks such as veterinary
29 diseases and food safety risks gained policy prominence after the BSE crisis in the
30 mid-1990s, and led to a drastic revision of EU food safety policy by the European
31 Commission. The nuclear policy responses in Germany and Switzerland after the
32 Fukushima disaster in Japan, 2011, are also a case in point, as well as the major
33 changes in foreign affairs, counterterrorism and immigration policies worldwide
34 after the September 11 attacks in the United States (Brandt, 2014).

35 The question arises what shifts and trends we see in the risk literature
36 regarding particular risk types. Which hazards and risks receive scholarly
37 attention, and from which perspective? This study sets out to report the shifts and
38 patterns in risk research across the past 30+ years. A similar exercise previously in
39 RHCPP (Kuipers & Welsh, 2017) for the crisis and disaster literature, reported that
40 on average only 14 percent of the articles in three crisis and disaster journals
41 pertained explicitly to risk research. Does risk research perhaps pay more attention
42 to crises than the other way around? Mapping risk research reveals not only which
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1 topics and themes have received increasing or structural attention but also which
2 ones perhaps deserve more study than they currently receive.

3 A review of the risk literature as published in three of the main specialized
4 journals over the years will tell us which risk types and theoretical themes
5 received most attention and allows us to visualize shifts and trends. Our
6 concluding section therefore has an agenda-setting character, suggesting avenues
7 for further research both within the interdisciplinary risk field and for collabora-
8 tion between risk and crises scholars.

9 Design

10 The analysis will include the results of codification of three independent
11 specialized academic journals in the risk research field: *RISK ANALYSIS*, the
12 *Journal of Risk Research* and the *European Journal of Risk and Regulation*.¹ The journal
13 *RISK ANALYSIS* (RA) has existed since 1981 and has a strong focus on risk
14 assessment. RA is published on behalf of the Society for Risk Analysis and
15 appeared four times per year in its first decade, six times per year in volumes 13–
16 28 and twelve times per year in volumes 29–37. The *Journal of Risk Research* (JRR),
17 established in 1998, shows a similar expansion: from four issues in its first six
18 volumes, rapidly moving to seven issues (volumes 7–8), to eight (volumes 9–13),
19 to 10 (volumes 14–19) to its current 12 (since volume 20 in 2017). JRR casts its net
20 widely, aiming to include both conceptual and empirical contributions 'at the
21 forefront of the communication, regulation and management of risk'. The
22 *European Journal of Risk and Regulation* (EJRR), established in 2010, has a different
23 focus both in terms of thematic interest (governance and regulation) as well as a
24 more specific geographic area (mainly the European Union). The expansion of the
25 journals as well as the number of issues shows the explosive growth of the
26 research field and its output in the past two decades. In total, we have coded
27 5,351 articles in 426 issues over a time span of 37 years.

30 Method

31 In order to illustrate the shifts in academic attention within the field of risk
32 research, we chose to take a "broad-brush" approach, counting the frequency of
33 key terms within the titles of all articles of each journal from their inception
34 through to 2018. To do so, we first developed umbrella categories, under which
35 to organize the codes for specific search terms. These were separated into "types"
36 and "themes," each with its own set of umbrella categories (Table 1).

37 We studied the collective bibliographies of all three journals, picking out
38 common terms and key words from both a thematic and risk type perspective.
39 The general pattern of these terms allowed us to create the categories above
40 inductively, and as each term appeared it was organized under the most fitting
41 umbrella category, resulting in a collection of 134 codes under risk types and 131
42 under risk themes. After the first round of coding, the categories were re-
43 examined, with some being merged to solidify into the 18 in the table ^{Q3}above.
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Table 1. Umbrella Categories

Risk Types (10)	Risk Themes (8)
Natural hazards	Risk governance (policy)
Transport	Citizen engagement
Corporate/economic risks	Risk communication
Hazardous materials/toxicity	Risk regulation
Environment	Risk perception
Food	Risk assessment
Health	Risk management
Technological	Risk materialization
Security/critical infra/terrorism	
Occupational	

Then the article titles of all three journals were searched for each term, with the frequencies recorded by year. If any one article title contained multiple key terms that fell under a single umbrella term (e.g., *seismic* and *hurricane* both of which fall under *Natural Hazards*), then only one was recorded, so as not to skew the overall results by coding a single article multiple times for the same theme or risk type. However, if an article title contained four key terms, all four falling under different umbrella terms, all four were coded.

Once the frequencies of all key terms had been searched for the *Journal of Risk Research* (the first journal coded), we re-examined its bibliography to see if any articles appeared that had not been covered by our search terms. A number of uncoded articles also provided us with additional key terms, and any new key terms were also retroactively searched for in those journals already examined. Once the collective bibliographies of all three journals had been searched for all key terms, these were collected into an aggregate count per year under each umbrella term. Two coders conducted all coding manually. We had two reasons for manual coding: we included for instance specific diseases such as BSE or tuberculosis under health as risk type, but it was impossible to specify all possible diseases, all possible toxic substances or hazardous materials (mercury, lead, LPG, etc.), all possible foods and beverages, companies or brands (Google, Monsanto, Volkswagen) and so on in advance whereas it was no problem identifying these as subject to specific risk types in the articles by manual coding. At the same time the inter coder-reliability was high (resulting in a Cohen's kappa of 0.89 for risk types and 0.88 for risk themes) while we realized a more specific and deliberate coding result.

Results

In the following section, we will show the variation of risks and perspectives researched in each journal and the trends over time. Figure 1 shows how often particular risk types as part of the article titles were coded for each of the three journals in the period 1981–2017.

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Risk Types per journal

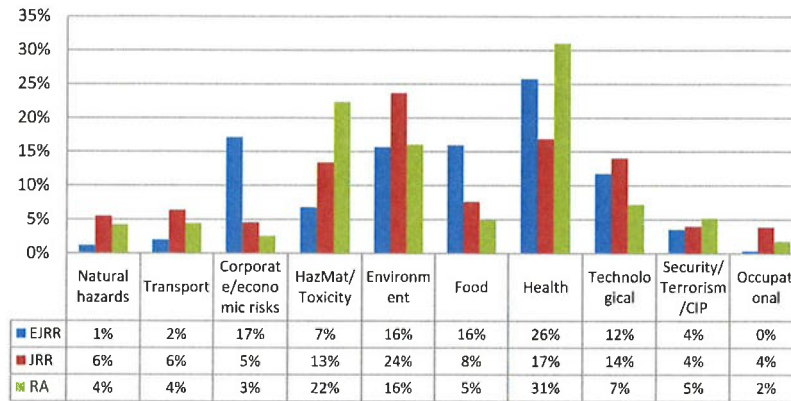


Figure 1. Risk Types per Journal (In Percentages, Based on Article Titles).

Overall, we see that *Risk Analysis* has a strong focus on the assessment of risks relating to toxic, microbial, or viral agents and their effects on human health, sanitation, food safety, and ecological environment. Almost three quarters of all articles between 1981 and 2017 address these particular risk types. Surprisingly little attention is paid to technological or industrial accident risks, security-related risks (such as terrorism), natural hazards, or logistics (crashes, collisions, traffic incidents). The *Journal of Risk Research* takes up more technological risks in its academic discussions but shows a similar neglect of the other risks. The *European Journal of Risk Regulation* has more eye for corporate, financial, and economic risks but also ignores occupational hazards. Figure 1 visualizes the attention for each risk type per journal.

If we look at the trends per risk type, for all journals combined, we see a rise in the share of articles addressing food safety and environment related risks. Food safety in our coding includes all references in titles to food and drinks products, production, preferences and consumption and ingredients (gluten, sugar) or traits (addictive, high calorie) of food. Environment-related means we coded title words such as climate, ecology, earth, organic, species, but also references to agriculture or land use and planning. Interest to risks pertaining to these categories was clearly increasing in academic risk literature.

Meanwhile the attention for hazardous materials/toxicity risks, and for health risks shows a relative decline. These risks have a continued presence in the research published in the oldest journal of the pack (*Risk Analysis*), but got competition from risks that receive more attention in the newer journals such as the *European Journal of Risk and Regulation* (much on food safety regulation, for instance) and the *Journal of Risk Research* which includes also risks that are increasingly subject to societal debate such as environmental risks and food-related lifestyle risks, see, Figure 2.

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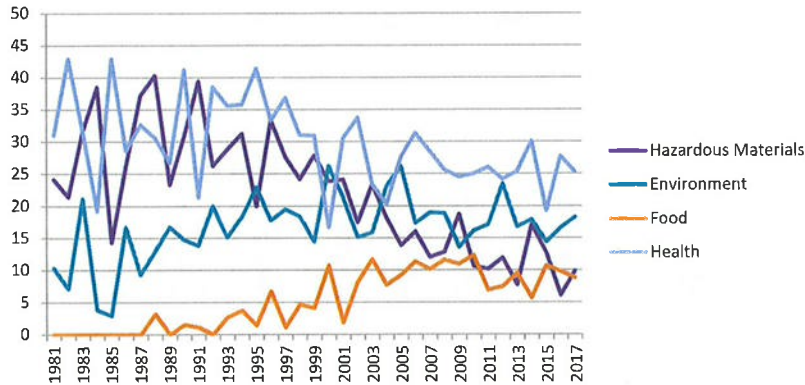


Figure 2. Trends in Attention for Specific Risk Types for All Three Journals Combined.

Figure 3 shows the share of specific themes or approaches that were identified from the articles for each of the three journals in the period 1981–2017, with 1981 being the year of conception for the journal RA, the JRR appearing since 1998 and the EJRR since 2010.

The majority of articles in the *European Journal of Risk and Regulation* covers governance (28 percent) and/or regulation (39 percent). Governance as a category pertains to all titles including reference to policy, administration, legislation, politics or political, reform and the public sector. The journal *Risk Analysis* does exactly what it promises: analyzing or assessing risks (47 percent). In the category risk assessment, we coded all title references to probability, evaluation, computation and analysis, measurements and tests, statistics, predictions and so on. The *Journal of Risk Research* spreads its attention most evenly over the different risk themes, with more attention for risk perception (including all references to social construction, amplification, attitude, awareness) and communication (references to media, transparency, marketing, warning, labelling but also representation,

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Risk Themes per journal

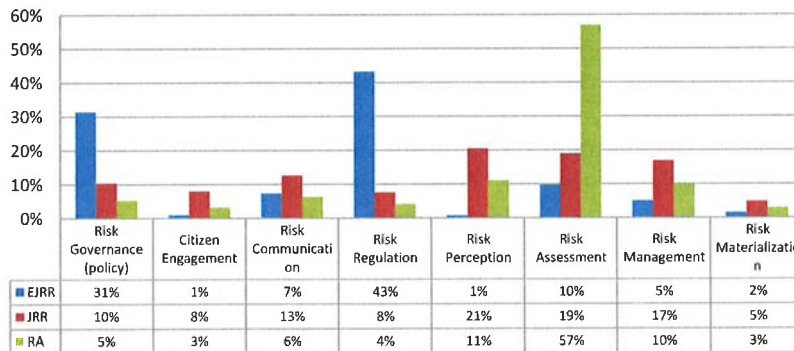


Figure 3. Themes per Journal (In Percentages).

trust, framing) in particular. Figure 3 visualizes the attention for each theme per journal.

If we look at the attention for particular themes by the journals in total, it becomes visible how the number of articles on regulation and governance increased over time, partly because of the creation of extra journals with that particular focus (EJRR). The perspective “Risk Assessment” receives continued and even increasing attention in absolute numbers of articles but its share of the total themes discussed decreased over time. Figure 4 shows the most prominent trends per theme over the years.

Now that trends and frequencies have been mapped for the three journals, the next section will discuss how the themes and types relate. The regression analysis reveals that articles address specific combinations of themes and risk types. The theme or perspective (for instance, citizen engagement, or regulation) that particular articles address, goes together with some risk types rather than others.

Analysis

In the introduction we raised the question which hazards and risks receive scholarly attention, and from which perspective? Also we wondered whether risk researchers perhaps pay more attention to crises than the other way around? In fact, within the risk literature, we see little interest in crises and disasters as materializations of risks. We only found a mere 22 titles explicitly relating to crises out of a total 5,351, and only 175 titles (3 percent) pertaining to a specific accident or incident (type) or crisis case. A focus on crises in risk research, if any,

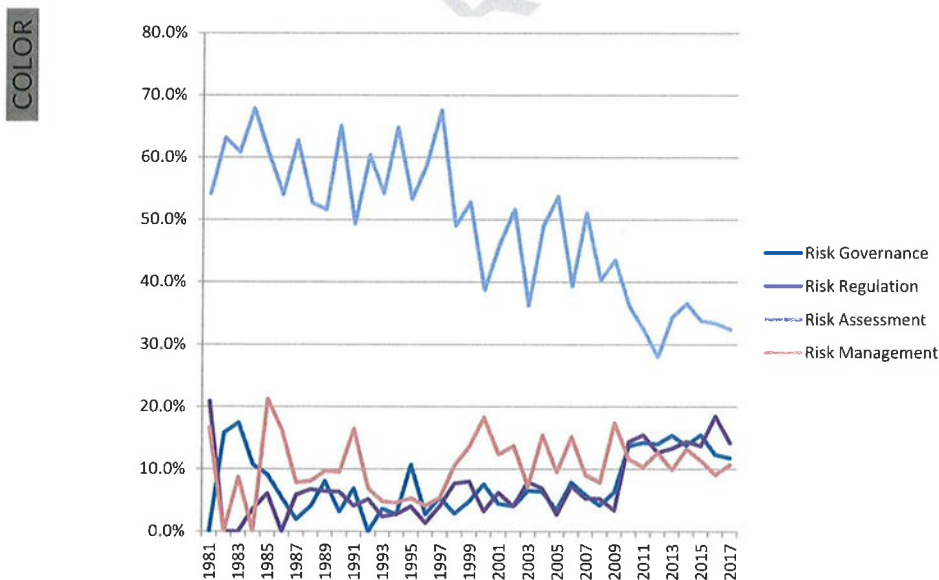


Figure 4. Trends in Attention for Specific Risk Themes for All Three Journals Combined.

1 often pertains to the common combination of “risk-and-crisis-communication,” a
2 metaphorical crisis of governance or regulation, and in only a small number of
3 articles to a more conceptual or theoretical contribution. Of the crisis cases
4 discussed, almost 20 percent pertain to two specific nuclear accidents (Fukushima
5 and Chernobyl), the so-called extreme high-impact cases with arguably low
6 probability, more than the titles on all natural disaster cases combined. The
7 attention for specific crises does not seem to relate to the frequency and
8 probability of their occurrence. By contrast, food safety and health risks, such as
9 infectious diseases, that constitute a large share of the risk assessment articles, are
10 only studied hypothetically (“if exposure X then effect Y”) in spite of the fact that
11 they seem to materialize more regularly. In fact, these risks produced some major
12 crises of the past decades, such as BSE, SARS, Swine Flu, and various dioxin
13 scandals.

14 Not do only articles on particular crisis-prone risk types lack attention for the
15 possibility of these risks becoming reality and manifesting themselves as crises.
16 Also, the risk themes discerned do not often combine with a focus on crises. For
17 instance, articles on citizen engagement focus primarily on how the introduction
18 or development of environmental and technological risks have influenced and
19 engaged citizens, communities and societies at large. The share of articles on
20 citizen engagement does not include attention for what happens to such
21 communities when they suffer from the consequences of these risks and
22 experience a real crisis.

23 In this section, we will discuss the most striking findings on how the attention
24 for different types and themes relates in more detail. The results of the
25 multivariate regression analysis of the different types and themes teach us how
26 some risk types are researched and discussed almost exclusively from a particular
27 angle. Also, the large majority of articles on some themes or perspectives only
28 take a limited variety of risks into account. The insight into these patterns helps
29 to detect avenues for future research on topics that seem as of yet understudied,
30 or on themes that are currently not addressed to a particular audience through
31 these risk journals. Figure 5 depicts the positive and negative associations
32 between the themes and types. A positive relation means that for instance articles
33 on natural hazards are most likely to address this risk type by looking at risk
34 perception, management or materialization. The negative relation between natural
35 hazards and regulation indicates that this risk type is unlikely to feature in an
36 article on risk regulation. In the annex of this article you will find the results of
37 the regression analysis.

38 If an article addresses risk governance, it is most likely to empirically pertain
39 to corporate and financial risks. A possible driver for this association is the high
40 number of EU policy related articles regarding financial system and banking
41 risks. To a lesser extent (but still significant at a 0.05 level), we found that articles
42 with a focus on governance mainly pertain to environmental and food safety
43 risks. By contrast, if an article is about risk governance, it is very unlikely to look
44 into hazardous materials, or health issues and most unlikely to look at
45 transportation risks.

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	Risk Governance	Citizen Engagement	Risk Communication	Risk Regulation	Risk Perception	Risk Assessment	Risk Management	Risk Materialization
Natural Hazards	/	/	/	-	+	/	+	+
Transport	-	-	-	-	/	+	+	+
Corporate/Economic Risks	+	/	-	+	-	-	/	/
Hazardous Materials/Toxicity	-	-	-	-	/	+	/	+
Environment	+	+	-	/	/	/	/	-
Food Safety	+	+	+	+	/	/	-	/
Health	-	-	-	-	-	+	-	-
Technological	/	+	/	/	+	-	/	/
Security/Critical Infra/Terrorism	/	-	/	-	-	+	/	+
Occupational	/	/	/	/	/	/	/	/

Figure 5. Associations Between Risk Types and Risk Themes. In this Table “/” Refers to Inconclusive (Insignificant at 0.05 Level), “+” Refers to a Significant Positive Association and “-” Refers to a Significant Negative Association.

If articles focus on how or why or to what effect citizens or stakeholders are engaged, these academic contributions are most likely to address risk types related to environment, food safety or technology, but not transportation risks, hazardous materials (including subs codes such as siting of chemical plants, transportation of nuclear waste, exploitation of shale gas) or security related risks such as terrorism. This neglect of the latter is surprising since citizens tend to get upset about the siting of a new hazardous plant (in policy sciences, the NIMBY or “not in my backyard” studies abound-starting as early as 1985 with Matheny & Williams; cf. Kraft & Clary, 1991; Fisscher, 1993) and they do express fear of terrorism (Liu et al., forthcoming). Apparently, the fact that risks upset communities does not lead to more studies on how to engage them to address such risks.

The majority of articles on risk communication concerns food safety as risk type. Risk communication is negatively related to other risk types, even health risks, which is surprising given the preoccupation with food safety. It is also very interesting to look into associations starting from the particular risk type. Food safety is studied both from the angles of communication and citizen engagement (clearly involving consumers and stakeholders, and how to reach or inform them), and from the perspective of governance and regulation.

Risk regulation is strongly associated with food safety as well as with corporate and financial risks in the literature ($p < 0.001$). This finding can be explained by the high number of articles on specific EU regulations, standards, procedures, court cases and principles related to food, and to banking risks. More surprising is the negative relationship between regulation and transportation

1 risks, and risks pertaining to hazardous materials. Sectors dealing with the latter
2 risks are subject to stringent regulation but are much less studied from that
3 perspective in the three journals examined here.

4 The way people perceive risks is studied mostly in relation to natural
5 hazards and technology-related risks. Risk perception studies are unlikely to
6 pertain to corporate risks, hazardous materials, health issues and security risks.
7 When it comes to assessing these risks, we find the opposite. Risk assessment
8 studies mainly pertain to health, transport, hazardous materials and security.
9 They are unlikely to address natural disaster risks or technological risks (i.e.,
10 risks related to automation, robotics, engineering, electricity, telecom and
11 cybertechnology). It is striking how academics study perception regarding some
12 types of risks, while devoting much less attention to the assessment of these
13 risks, and vice versa.

14 Risk management seems to pertain mostly to natural hazards in the literature.
15 Other types of centuries-old risks, such as food and health risks, are however
16 most unlikely to get attention from a risk management perspective. Health risks
17 are extensively assessed, food safety is significantly communicated and regulated,
18 but neither of these risks are studied often as risk management issues.

19 Materialization of risks, the starting point of this analysis, is primarily related
20 to natural hazards and transportation risks. Apart from the two specific nuclear
21 accidents (Fukushima and Chernobyl), mentioned earlier, the cases of past crises
22 discussed in the three journals are usually natural disasters (hurricane Katrina
23 tops the list) or plane and train crashes, followed by terrorist attacks (security
24 risks) and toxic spills (hazardous materials).

25 26 **Conclusion and Avenues for Further Research**

27
28 Not so much the types of crises (natural hazards-, transportation-, security-,
29 and toxicity-related crises) that risk scholars look into give rise to surprise, but
30 the infrequency by which such crises are studied. In addition, the types of risks
31 that receive scholarly attention when materialized in real-life devastating cases,
32 are exactly the risk types that get least attention from the perspective of
33 governance, citizen engagement, communication, and regulation (see Figure 5).

34 By contrast, the themes governance, citizen engagement, communication and
35 regulation are the ones that get most attention in the crisis literature. Kuipers and
36 Welsh (2017) show in their review of the crisis and disaster literature that most
37 attention goes to crisis preparedness (covering subthemes and codes that in this
38 study resort under "risk governance," such as policy making and implementa-
39 tion). Next in line in the crisis literature is community resilience (covering
40 subthemes here coded under "citizen engagement") after crises and disasters. The
41 high politics of crisis management (think of accountability and blaming) and
42 crisis communication are also prominent themes in the crisis and disaster
43 literature. However, in the risk literature, the risk types that are studied in
44 relation to their disastrous consequences, are hardly studied from a perspective
45

1 that pertains to government responsibilities and citizen expectations regarding.
 2 Meanwhile, as Ansell and Bauer (2018) argue, risk regulation regimes in practice
 3 shifted from a narrow-based forensic focus to a much wider and societal concern
 4 about what constitutes risk.

5 Both risk and crisis studies are likely to gain by looking into each other's
 6 strongholds. Learning from the mitigation and consequences of risks that material-
 7 ize as crises, could inform studies on risk analysis and risk governance. Crises
 8 produce shifts in problem framing, and these shifts in turn "lead to new techniques
 9 of risk control" (Ansell & Bauer, 2018, p. 21). Also, crisis studies highlight the
 10 human and organizational causes of crises, a factor that is often overlooked in risk
 11 assessments because it is more difficult to quantify with the existing approaches.

12 Crisis studies are still criticized for being too much event-focused, and often
 13 fail to include the accumulation of deficiencies that produced the negative event
 14 at hand (Roux-Dufort, 2016). Crisis researchers could learn from the risk field to
 15 see the broader patterns and bigger picture of recurrent events. The *Journal Risk,*
 16 *Hazards & Crisis in Public Policy* recognizes the importance of bridging between
 17 the crisis and the risk fields of research. Mapping what is out there is a first step
 18 to convening the future roads of research.

19
 20 **Sanneke Kuipers** is the editor-in-chief of RHCPP. [s.l.kuipers@fgga.leidenuniv.nl]

21 **Bob van Grieken** is editorial assistant of RHCPP.

22 **Marjolein B. A. van Asselt** is an editorial board member of RHCPP.

23 24 25 Notes

26 The authors would like to thank Arjen Boin and Jaroslaw Kantorowicz for their helpful feedback.

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 28 1. This is only a selection of the existing risk journals. Others such as the journals *Health, Risk &*
 29 *Society; Risk and Decision Analysis;* and the *Journal of Risk and Uncertainty,* to name a few, cover
 30 similar scholarly work, similar topics, and similar years. Many academic journals cover more
 31 specific risk areas, such as the *Journal of Healthcare Risk Management; Journal of Hazardous Materials;*
 32 *Journal of Risk and Financial Management,* or the *International Journal of Disaster Risk Science.*

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APPENDIX

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18 **Table A1.** Logistic Regression Models of Risk Themes and Risk Types^{Q5}

	Model 1	Model 2	Model 3
	Risk Governance (Policy)	Citizen Engagement	Risk Communication
Natural hazards	-0.452 (0.266)	0.474 (0.260)	-0.279 (0.254)
Transport	-0.912 (0.345)**	-1.194 (0.587)*	-1.668 (0.509)**
Corporate/economic risks	0.706 (0.187)***	-0.679 (0.459)	-0.975 (0.366)**
Hazardous materials	-0.305 (0.145)*	-0.248 (0.214)	-0.899 (0.192)***
Environment	0.262 (0.122)*	0.362 (0.170)*	-0.552 (0.164)***
Food	0.374 (1.71)*	-0.843 (0.420)*	0.636 (0.166)***
Health	-0.441 (0.123)***	-0.959 (0.221)***	-0.644 (0.138)***
Technological	0.236 (0.165)	0.537 (0.210)*	0.0404 (0.184)
Security/critical infra/ terrorism	-0.256 (0.241)	-0.902 (0.460)*	-1.173 (0.365)**
Occupational	-1.054 (0.591)	-0.185 (0.595)	-0.160 (0.430)
Constant	-2.165 (0.069)***	-2.952 (0.099)***	-2.069 (0.070)***
N	5,352	5,352	5,352
LR Chi ² (10)	62.51	63.62	114.35
Pseudo-R ²	0.0184	0.0340	0.0380

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35 Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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Table A2. Logistic Regression Models of Risk Themes and Risk Types

	Model 4	Model 5	Model 6
	Risk Regulation	Risk Perception	Risk Assessment
Natural hazards	-2.061 (0.508)***	0.572 (0.170)***	0.0276 (0.143)
Transport	-0.565 (0.283)*	-0.308 (0.241)	0.398 (0.142)**
Corporate/economic risks	0.860 (0.176)***	-0.747 (0.281)**	-0.558 (0.158)***
Hazardous materials	-0.494 (0.149)***	-0.320 (0.131)*	0.542 (0.079)***
Environment	-0.193 (0.133)	0.213 (0.112)	0.110 (0.080)
Food	0.333 (0.166)*	0.304 (0.162)	-0.0575 (0.118)
Health	-0.552 (0.122)***	-0.583 (0.115)***	0.870 (0.068)***
Technological	0.133 (0.166)	0.575 (0.136)***	-0.414 (0.117)***
Security/critical infra/terrorism	-1.567 (0.388)***	-0.743 (0.257)**	0.338 (0.134)*
Occupational	-0.879 (0.517)	0.462 (0.291)	0.302 (0.224)
Constant	-1.945 (0.065)***	-1.878 (0.062)***	-0.589 (0.043)***
N	5,352	5,352	5,352
LR Chi ² (10)	124.65	98.37	281.04
Pseudo-R ²	0.0356	0.0245	0.0385

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A3. Logistic Regression Models of Risk Themes and Risk Types

	Model 7	Model 8
	Risk Management	Risk Materialization
Natural hazards	0.916 (0.161)***	1.730 (0.217)***
Transport	0.384 (0.193)*	0.984 (0.265)***
Corporate/economic risks	0.179 (0.207)	0.142 (0.374)
Hazardous materials	-0.205 (0.134)	0.469 (0.198)*
Environment	0.00487 (0.125)	-1.100 (0.347)**
Food	-0.535 (0.232)*	-1.143 (0.588)
Health	-0.858 (0.134)***	-0.484 (0.229)*
Technological	-0.258 (0.179)	-0.122 (0.309)
Security/critical infra/terrorism	0.174 (0.189)	0.635 (0.278)*
Occupational	-0.00660 (0.358)	0.798 (0.436)
Constant	-1.946 (0.065)***	-3.486 (0.122)***
N	5,352	5,352
LR Chi ² (10)	110.36	107.58
Pseudo-R ²	0.0295	0.0680

Note: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

