

# **The Predictive Power of Mass Media Channels for Health-Related Risk Perception of the Fukushima Nuclear Accident**

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## **Note:**

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## **ABSTRACT**

The media play an important role in risk communication, providing information about accidents, both nearby and far away. Each media channel has its own presentation style, which could influence how the audience perceives the presented risk. This study investigates the predictive power of twelve media channels (traditional media, new media and social media) for the perceived risk posed by radiation released from the damaged Fukushima nuclear power plant on respondents' own health and that of the population in general. The analysis controlled for attitude towards nuclear energy, gender, education, satisfaction with the media coverage and duration of attention paid to the coverage. The study uses empirical data from a public opinion survey ( $N > 1,000$ ), which are representative for the Belgian population with respect to six socio-demographic variables. Results show that some media channels do influence risk perception. Television, interpersonal communication and the category of miscellaneous online sources are significant predictors of the perceived health-related risk of the nuclear accident. More favourable attitudes towards nuclear power, longer attention to the coverage, and higher satisfaction with the provided information predict lower risk perception. Interpersonal communication is significantly related to satisfaction with the coverage: those unsatisfied with the information were more likely to engage in interpersonal communication. Taken together, the results suggest that the media can indeed have an influence on how the audience perceives a risk.

### **Keywords:**

Fukushima nuclear accident, risk perception, traditional media, new media, social media

## 1. INTRODUCTION

Fortunately, major nuclear accidents do not occur often. Unfortunately, this means that research regarding how the public perceives the risk of actual nuclear accidents, and how these perceptions are shaped, is also comparatively rare. While risk is essentially all about probabilities<sup>(1)</sup>, people rarely use statistical methods when making judgements about risks in daily life.<sup>(2)</sup> To form a perception of risk, people take into account various other factors, often qualitative in nature.<sup>(1, 3, 4)</sup> This way, they can worry a lot about comparatively minor or very unlikely risks, while ignoring things that really threaten them. Major events, such as the 2011 Fukushima nuclear accident, can quickly make people aware of the prominence of a risk, and can make them more afraid even though the probabilities have not changed.

The media play an important role in risk communication.<sup>(e.g., 3, 5, 6, 7)</sup> They provide the public with information about what happened. However, by doing so, they may also influence their audience. This can happen on purpose (with biased articles), but also unknowingly. Kaspersen et al.<sup>(3)</sup> pointed to the possibility that each transmitter of information will change the original message by intensifying, weakening and/or filtering parts of it. As such, media are not just neutral intermediaries: they will change the information in the process, and this might influence the recipients of their messages. It is plausible that the unique characteristics of different media channels (regardless of content) may lead to different effects on their audience as well - which was already articulated in the much-quoted catchphrase “the medium is the message”.<sup>(8)</sup>

The Fukushima nuclear accident offered a unique opportunity to study the effects that different media channels can have on the risk perception of actual nuclear accidents. Previous research on this topic is rare, often uses convenience samples and generally studies only a limited number of media channels. This study, on the other hand, included twelve media channels

(including traditional media, new media and social media), using a large sample ( $N = 1,002$ ) that was representative for the Belgian population.

The present study investigated whether media use during the Fukushima nuclear disaster in 2011 had predictive power for the long-term risk perception in 2013, several years after the accident. More specifically, it explored the risk that respondents thought the radiation released from the damaged Japanese plant would have on their own health and on that of the general population. For example, the audience might believe that the radiation from Fukushima could increase the amount of cancers in Belgium.

Belgium is an interesting case, notwithstanding the large distance between the country and Fukushima. Nuclear energy has been on the public agenda for a while now: in 2003, Belgium decided to phase out nuclear energy, but at the time of the accident it still had seven operational reactors. In 2013, development on a new research reactor started - evidence of a somewhat mixed relationship with the nuclear domain. Furthermore, the distance from the site of the nuclear accident provides the opportunity to compare the media use and effects of the indirectly affected Belgian population with available data from the directly affected population.<sup>(9)</sup>

## **2. LITERATURE REVIEW**

### **2.1. Media Channels: Fostering our Actual and Imagined Fears?**

Previous studies have provided some support for the hypothesis that media channels can have an influence on risk perception. Coleman<sup>(10)</sup> studied the influence of four media channels (newspapers, magazines, books and television) and interpersonal communication on risk perception in New York State. She found that media channels have a limited influence on both personal and voluntary societal risk. For involuntary societal risk, interpersonal communication with spouses or neighbours turned out to be the only communication channel that had significant influence.

Research conducted in Japan regarding the Fukushima nuclear accident found that there were pronounced differences in the fears people had, depending on the kind of media they used as their source of information.<sup>(9)</sup> Those who listened to rumours were more fearful of the possible effects of radiation on their health. Readers of regional newspapers were more worried about the prospects for the future, while those who read the national newspapers were less worried. Respondents who listened to radio news were more fearful of social disruption breaking out in the aftermath of the accident. Neither television nor Internet use showed any significant correlations with either of these concerns. It is important to note, however, that these particular results are inherently linked to the Japanese context: for example, it is known that Japanese national newspapers tend to avoid controversies in order to protect the consensus and the harmony of Japanese society.<sup>(11)</sup>

Newspapers are judged as highly trustworthy by the public: in studies conducted shortly after the Fukushima nuclear accident, both Japanese consumers<sup>(12)</sup> and Japanese parents<sup>(13)</sup> ranked them as the second most trustworthy source of information, immediately after NHK

(*Nippon Hōsō Kyōkai*, Japan's public broadcaster). It has also been experimentally demonstrated that newspapers are perceived as more credible than social media, which results in more people being willing to share their content online.<sup>(14)</sup> On the other hand, fewer Belgians (47%) rated newspapers as (very) trustworthy in the case of a nuclear accident, as compared to television (70%) and radio (65%).<sup>(15)</sup>

An important role of newspapers is to provide the public with greater detail than what the other, “faster” media are able to. In the case of the Fukushima nuclear accident, newspapers and their associated websites gave extensive coverage: they often used infographics, multimedia and explanatory articles written by experts to inform their audience.<sup>(16)</sup> They also provided ample opinion pieces by different stakeholders.<sup>(17)</sup> In this way, newspapers were able to give their public a broader context and different perspectives on the disaster. However, readers of newspapers also have the choice not to read a certain article if it does not capture their interest.<sup>(18)</sup>

The public also deems television to be highly trustworthy, both in Belgium<sup>(15)</sup> and in Japan in the aftermath of Fukushima. The public broadcaster in particular was seen as highly trustworthy.<sup>(12,13)</sup> Television news differs from newspaper news in different respects. Frewer, Rowe and Sjöberg<sup>(18)</sup> name two: firstly, television news draws a greater audience. Secondly, the audience does not have the same freedom in choosing what topics to watch: if a topic is featured in television news, the audience cannot help but watch it. Henning and Vorderer<sup>(19)</sup> suggest that this “linearity” would also make it more difficult for the viewers to think autonomously, since they cannot pause the broadcast to ponder upon the content. Thirdly, due to time constraints, television was not able to give the same extensive background and context that newspapers provided.<sup>(16)</sup> Television tells the public a hazard exists, but gives little background information beyond that.<sup>(18, p. 20)</sup>

It is important to note the possible effects of visuals. Concerning printed media, research by

Zillmann, Knobloch and Yu<sup>(20)</sup> showed that the audience is significantly more likely to read articles accompanied by visuals, and read these articles with more attention. Moreover, if the accompanying image shows impending danger or damage caused by a threat, the audience recalls more information from the text. These effects could be more outspoken for the moving images on television: according to Reeves and Nass<sup>(21)</sup>, the audience pays even more attention to a moving image than to a still one and attributes more importance to vivid information. Furthermore, they demonstrated that some types of movement (such as images “coming closer”) could make viewers feel threatened. Aust and Zillmann<sup>(22)</sup> found that television reports featuring upset victims cause the public to rate the presented risk as more dangerous to both themselves and people in general.

Public broadcast radio was deemed highly trustworthy by the public in Japan, whereas the results on private channels were more mixed: Japanese consumers thought them to be highly trustworthy as well.<sup>(12)</sup> However, Japanese parents did not share this favourable view.<sup>(13)</sup> The Belgian public rated the radio as the second most trustworthy media channel after television.<sup>(15)</sup> Similar to television, radio news is linear, preventing the listeners from choosing what news to pay attention to. However, it misses the visuals that make television more engaging.

The Internet gave rise to both great opportunities and problems for risk communication<sup>(16, 23)</sup>: it all but nullified the gatekeeping function of the traditional media, and gives unconventional experts a platform to distribute understandable information to the public, which can interact with these experts and among themselves. On the other hand, the Internet also helps the spread of misinformation, due to the very rapid news cycle it demands - with little room for fact-checking - and by giving a voice to people who may not have the necessary knowledge to accurately discuss complex issues. Additionally, once information, correct or false, went viral, few bothered to check its accuracy. Given these potential problems, it is perhaps not surprising that the public is

wary when it comes to Internet sources such as social media, judging them to be significantly less credible than other media channels.<sup>(12, 14)</sup> This perception might not match reality, seeing as tweets tagged with #fukushima often cited highly reliable sources.<sup>(12)</sup> Finally, the International Atomic Energy Agency<sup>(24)</sup> advised public information officers that in the case of a nuclear emergency, risk communication is most likely to succeed when communication is a two-way process. Since the possibility of interaction and two-way communication is a main feature of social media<sup>(14)</sup>, it is reasonable to assume that social media would be highly effective in managing risk perception.

YouTube is the third most accessed site on the Internet, according to Alexa.com (1 October 2014). As such, it could play a major role in risk communication as well. However, research suggests that a majority of YouTube clips can be classified as “entertainment”, with only a small amount of videos in the categories of “News & Politics”, “Education” and “Science & Technology”.<sup>(25)</sup> Similarly, the share of college students that had watched at least some comedy-format news shows was somewhat larger than the share of people that had watched at least some traditional news shows on YouTube. The sharing rate was also higher for “comedy” news than for traditional news.<sup>(26)</sup> However, other studies<sup>(27)</sup> have shown that even entertainment programs can increase risk perception. As of yet, it is still unclear how YouTube clips will influence risk perception.

Although the different media channels have transformed the way in which risks are communicated, interpersonal communication still plays an important role in the diffusion of high impact stories: people will likely continue to talk with each other about important news events. Although information received from interpersonal communication might not be as detailed as information from the mass media, people still seem to attribute greater trustworthiness to information they heard from others, compared to information from a media channel.<sup>(28)</sup> After the

Fukushima nuclear disaster, parents in Japan indeed judged family and relatives as highly trustworthy: in fact, they were the second most trusted group, with only academic scientists deemed more trustworthy.<sup>(13)</sup> Coleman<sup>(10)</sup> found that interpersonal communication with spouses or neighbours had significant influence on risk perception of involuntary societal risk. In the aftermath of Fukushima, rumours were significantly associated with fear of radiation and health-related risk perception.<sup>(9)</sup>

All these studies led to the following research question:

**RQ1:** Can the use of specific media channels predict the long-term health-related risk perception of the 2011 Fukushima nuclear accident?

## **2.2. Duration of Attention Paid to the News**

Wählberg and Sjöberg<sup>(29)</sup> point to the availability heuristic as a theory often used in explaining risk perception: the easier one can recall a certain event happening, the more probable he or she will judge the likelihood of that event happening again. Extensive media coverage is one way in which events could become easier to recall<sup>(30)</sup>, which would lead to people overestimating the probability of that kind of event.<sup>(1, 7)</sup> The fact that the Fukushima nuclear accident was compared to the Chernobyl nuclear accident in both the United States<sup>(31)</sup> and the European Union<sup>(32)</sup> would make these accidents more “accessible” to the public, especially to people who paid attention to the news for a long period of time. The literature suggests they will have higher risk perception as a result.

**H1:** People who followed the news about the Fukushima nuclear accident for a longer period of time have higher risk perception than people who followed it for a shorter

amount of time.

### **2.3. Satisfaction with Media Coverage**

The role of the media in risk communication is - first and foremost - to provide the public with information. The Chernobyl nuclear accident demonstrates that a lack of information during a crisis situation creates uncertainty, which in turn exacerbates existing fear and stress.<sup>(33, 34)</sup>

Even if information is available and accessible, the public may still not find it satisfactory. During the Fukushima nuclear accident, the provided information did not suit the needs of parents in Japan, what led them to experience higher anxiety.<sup>(13)</sup>

Even if the population is not directly affected by the nuclear accident, satisfactory media coverage would probably prevent respondents from experiencing unnecessary uncertainty, anxiety and stress, which would lower their perceived risk.

**H2:** Those who are more satisfied with the media coverage about the Fukushima nuclear accident have a lower risk perception of it than people who are less satisfied.

### **2.4. Context Variables**

Based on existing literature, attitudes towards nuclear energy in general<sup>(e.g., 35, 36, 37)</sup>, gender<sup>(e.g., 13, 38, 39, 40)</sup> and education<sup>(e.g., 2, 10, 41, 42)</sup> can also have an influence on risk perception, so these variables were added to both analyses in order to test the influence of media channels in the wider context of risk perception.

**H3:** Attitudes towards nuclear energy, education and gender will have significant

predictive power for long-term health-related risk perception.

### 3. METHODOLOGY

This study was conducted using empirical data from the SCK•CEN Barometer 2013<sup>(43)</sup>, a public opinion survey that was conducted with computer-assisted personal interviews. A company specialised in opinion research carried out the data collection between 15 August and 12 September 2013. The Fukushima nuclear accident was still featured in the news when the fieldwork was conducted, with 196 articles featuring “Fukushima” published in all Belgian newspapers (search conducted on 26 February 2014 using academic.gopress.be).

In order to gather representative data, a list of all Belgian municipalities was first divided into a total of 44 strata. The data were then gathered using a random walk method within each stratum.<sup>(43)</sup> The questionnaire gauged respondents’ attitude towards and knowledge about nuclear energy, and trust in and knowledge about several actors in the nuclear field. Finally, a section was devoted on the Fukushima nuclear accident, with questions regarding perception of the accident, solidarity with the victims, media use, and attitude towards contaminated foods and goods. Most questions had respondents answering using a Likert scale, with an option to not answer. Within most question sets, there was randomisation of the question order to combat order effects.

A total of 1,002 respondents were interviewed face-to-face, in Dutch or French. After a weighing procedure, the sample was representative of the adult Belgian population with respect to gender, age, region, size of locality, education, professional activity and the size of household. All results reported in this paper made use of the weighed sample.

Of the total sample, 64 respondents (6.4%) were not aware of the nuclear accident that happened in Fukushima. This group contained more women,  $\chi^2 = 11.37$ ;  $df = 1$ ;  $p = 0.001$ , and was more likely to have no degree or only to have finished elementary school,  $\chi^2 = 54.23$ ;  $df = 8$ ;  $p < 0.001$ . They were more likely to live in Flanders,  $\chi^2 = 21.65$ ;  $df = 2$ ;  $p < 0.001$ , and to have

less members in their household ( $M = 2.46$ ,  $SD = 1.34$ ) compared to those who were aware of the accident ( $M = 2.82$ ,  $SD = 1.35$ ),  $t(1000) = 2.09$ ;  $p = 0.037$ . There were no significant differences with respect to age,  $t(68.662) = 0.779$ ;  $p = 0.439$ , the level of urbanisation of their municipality of residence,  $\chi^2 = 1.76$ ;  $df = 3$ ;  $p = 0.623$ , or their income levels,  $\chi^2 = 19.1$ ;  $df = 12$ ;  $p = 0.086$ . Since these respondents were not asked any further questions regarding their media use during the coverage of the Fukushima nuclear accident, they were not taken into account in this study. This left a total of 938 valid respondents for analysis.

### **3.1. Operationalisation**

The *use of the media channels* was measured by asking respondents which media channels had been their important sources of information about the accident. Respondents could then pick as many options as they wanted from a list. Those who selected “Internet” as one of their initial choices were then presented with another list with the various Internet sources.

For the dependent variable, the *risk perception* of the Fukushima nuclear accident, a scale was constructed using principal component analysis with Oblimin with Kaiser Normalisation. The factor analysis yielded a single factor, consisting of three items from the questionnaire. “In the near or far future, how high do you deem the risk that the radiation from the Fukushima nuclear accident poses to your own health?” and “In the near or far future, how high do you deem the risk that radiation in food products or other products from Japan poses to your own health?” were both measured from 1 (“no risk at all”) to 6 (“very high risk”). The third question, “Will the number of cancers in Belgium increase because of the accident in Fukushima?”, was measured from 1 (“strongly disagree”) to 5 (“strongly agree”). The obtained factor accounted for 70.95% of the variance and had good internal consistency (Cronbach’s alpha = 0.794). Since the items used different scales, internal reliability was measured using the factor scores. Each component in the

scale of risk perception had a factor loading of 0.77 or higher. A low score on the scale signified a low risk perception of the Fukushima nuclear accident.

The *satisfaction* of respondents with the information they got from the media was measured using a single question: “In general, how satisfied were you with the information you got about the (Fukushima) accident?”. The possible answers ranged from 1 (“very unsatisfied”) to 5 (“very satisfied”).

*Duration*, which stands for how long respondents followed the news about the nuclear accident, was also measured using a single question: “How long did you pay attention to news about the Fukushima accident?”. Answers ranged from 1 (“I did not follow the news about Fukushima at all”) to 6 (“I am still following the news about Fukushima”).

The *attitude towards nuclear power* was measured using the answers to “What is your opinion on nuclear energy?”. The Likert scale ranged from 1 (“totally in favour of nuclear power”) to 5 (“totally against”).

### **3.2. Analysis Procedures**

The predictive power of the media channels for the long-term health-related risk perception was calculated using two linear regression analyses. The first analysis was limited to the major categories of media channels (i.e., television, radio, newspapers, Internet and interpersonal communication - hereinafter referred to as “primary media channels”). Due to the range of online sources, a second analysis was run focusing on the different sources on the Internet. Satisfaction with the coverage and duration of attention were included in both analyses, as were attitude towards nuclear energy, gender and education. Education was recoded to have three levels. The lowest level of education consisted of respondents with no degree, an elementary level degree or

a lower secondary degree. The intermediate level consisted of people with a higher secondary level degree, whereas respondents in the high level held a higher education degree, either from a university or non-university higher education.

## 4. RESULTS

### 4.1. Media as Important Information Sources

The media played an important role in informing the public about the nuclear accident in Fukushima. Which media channels were most widely used, is shown in Tables I and II. The existence of a multimedia society is also apparent from the results: 66.6% of respondents used more than one media channel to inform themselves about the accident. On average, people used 2.56 media channels ( $SD = 1.42$ ) in their search for information about the accident. The majority of single-medium users were people who exclusively watched television (accounting for 25.04% of the total sample).

**Table I: Main Information Sources for the Fukushima Nuclear Accident**

	Percentage
Television	93.4
Radio	49.6
Newspapers	48.5
Internet	29.8
Interpersonal Communication	16.2
<b>Total</b>	<b>100</b> <b>(N = 938)</b>

*Note:* Measured as a percentage of all valid respondents; non-exclusive options

Similar results appear for the online media channels: 63.9% of Internet users consulted more than one online information source. On average, they used 2.10 online media channels ( $SD = 1.07$ ). However, the distribution is skewed: none of the respondents answered as having used all seven response options the questionnaire offered and only 10.2% of the audience had used more than three.

**Table II: Online Information Sources for the Fukushima Nuclear Accident**

	<b>Percentage of Internet Users</b>
Online Newspapers	84.0
TV and radio station websites	49.9
(Non-)governmental agencies websites	27.6
Facebook	26.4
Blogs	10.2
Others (for example: YouTube)	8.9
Twitter	3.3
<b>Total</b>	<b>100 (N = 280)</b>

Note: Measured as a percentage of all Internet users; non-exclusive options

With the exception of television, all primary media channels were significantly correlated (at the 0.001 level) with the duration of attention paid to the media coverage (detailed results in Appendix). Additionally, three online sources were significantly correlated with the duration of attention, each at the 0.01 level, using a two-tailed test. Those who answered as having used a blog ( $r = 0.194$ ) or the websites of (non-)governmental agencies ( $r = 0.175$ ) were more likely to have paid attention to the coverage for a longer time. On the other hand, people who used Facebook ( $r = -0.158$ ) were more likely to stop paying attention to the news sooner.

Additionally, interpersonal communication was significantly correlated with satisfaction with media coverage ( $r = -0.113$ ,  $p = 0.001$ ), signifying that people who were not satisfied with the media coverage were more likely to engage in interpersonal communication. The use of websites of (non-)governmental agencies ( $r = -0.114$ ,  $p = 0.058$ ) and blogs ( $r = -0.117$ ,  $p = 0.051$ ) both approached a significant negative correlation with satisfaction (detailed results in the Appendix).

## 4.2. Influencing Factors of Long-Term Health-Related Nuclear Risk Perception

The relationship between the media channels and risk perception was analysed using linear regression analysis,  $R^2 = 0.171$ ,  $F(10,817) = 16.86$ ,  $p < 0.001$  (see Table III for results). The independent variables were all entered in the analysis at the same time. The dependent variable was the factor scale of the risk perception of the Fukushima nuclear accident.

**Table III: Predictive Power of Primary Media Channels for Long-Term Risk Perception**

<b>Model: Risk Perception of the 2011 Fukushima Nuclear Accident</b>			
<b>Predictor</b>	<b><math>\beta</math></b>	<b><math>p</math></b>	<b><math>SE</math></b>
Gender	0.052		0.064
Attitude towards nuclear energy	0.291	***	0.034
Education	- 0.139	***	0.044
Duration of attention paid to media coverage	- 0.076	*	0.022
Satisfaction with media coverage	- 0.120	***	0.035
Media Channel: Television	0.064	*	0.138
Media Channel: Radio	0.022		0.068
Media Channel: Newspapers	- 0.051		0.070
Media Channel: Internet	- 0.020		0.074
Interpersonal Communication	0.117	***	0.088
Constant			0.269

$N = 828$

*Adjusted R*<sup>2</sup> = 0.161

*Note:* Linear regression analysis; Dependent variable: factor scores of risk perception of the 2011 Fukushima nuclear accident

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$

Out of the five primary media channels studied, only two turned out to be significant predictors of the risk perception of the Fukushima nuclear accident: watching television ( $\beta = 0.064$ ,  $p = 0.048$ ) and engaging in interpersonal communication ( $\beta = 0.117$ ,  $p < 0.001$ ) both predicted higher risk perception.

With the exception of gender, all other variables included in the analysis were significant predictors. The duration of attention paid to the media coverage was significant, but in the opposite direction than **H1** predicted ( $\beta = -0.076, p = 0.024$ ): respondents who paid attention to the news about Fukushima for a longer period of time had a lower risk perception. As predicted by **H2**, higher satisfaction with the media coverage was associated with lower risk perception ( $\beta = -0.120, p < 0.001$ ). Attitude towards nuclear energy was the most influential predictor ( $\beta = 0.291, p < 0.001$ ): people who have a positive attitude towards nuclear power had a lower risk perception. Education had the second highest regression coefficient ( $\beta = -0.139, p < 0.001$ ): people with a higher level of education did have lower risk perception, compared to those with a lower level of education. This provides limited support for **H3**, with two out of three context variables being significant predictors.

An additional regression analysis was run for the different Internet sources,  $R^2 = 0.211$ ,  $F(12,244) = 5.46, p < 0.001$  (see Table IV for results). Once again, all variables were entered at the same time.

Only one Internet source had significant predictive power. “Other sources, such as YouTube” had a highly significant negative  $\beta$ -coefficient ( $-0.186, p = 0.002$ ). Attitude towards nuclear energy turned out to be the strongest predictor ( $\beta = 0.229, p < 0.001$ ). The second most important predictor was satisfaction with media coverage ( $\beta = -0.204, p = 0.001$ ), in the direction expected by **H2**. Gender became a significant predictor online: women had a significantly higher risk perception than men ( $\beta = 0.151, p = 0.01$ ). Both educational level and duration of attention lost their predictive power, but educational level did approach significance ( $\beta = -0.114, p = 0.058$ ). Again, **H3** received limited support, with two out of the three context variables being significant.

**Table IV: Predictive Power of Online Sources for Long-term Risk Perception**

<b>Model: Risk Perception of the 2011 Fukushima Nuclear Accident</b>			
<b>Predictor</b>	<b><math>\beta</math></b>	<b><math>p</math></b>	<b><math>SE</math></b>
Gender	0.151	**	0.113
Attitude towards nuclear energy	0.229	***	0.059
Education	- 0.114		0.082
Duration of attention paid to media coverage	- 0.100		0.040
Satisfaction with media coverage	- 0.204	***	0.061
Media Channel: Online newspapers	0.040		0.160
Media Channel: TV and radio station websites	- 0.021		0.116
Media Channel: (Non-)governmental agencies websites	0.094		0.131
Social Medium: Twitter	0.021		0.328
Social Medium: Facebook	0.042		0.136
Social Medium: Blogs	- 0.066		0.195
Media Channel: Others (for example: YouTube)	- 0.186	**	0.208
Constant			0.417

$N = 257$

*Adjusted R*<sup>2</sup> = 0.173

*Note:* Linear regression analysis; Dependent variable: factor scores of risk perception of the 2011 Fukushima nuclear accident  
 \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$

## 5. DISCUSSION

This study set out to investigate the influence of twelve communication channels on the long-term risk perception of the Fukushima nuclear accident, about two and a half years after it occurred, and aimed to contribute to the understanding of the relationship between media and risk perception in several different ways. Firstly, because a representative data set was used, the results would be perceived as more easily generalised. Secondly, this study considered the effects on perceived risk of an *actual* nuclear accident, rather than a hypothetical one. Finally, a whole range of media channels was included in the analyses, instead of focusing on just a couple. In particular, the role of radio has rarely been studied, even though the results showed that it was an important source of information for about one out of two respondents.

The first research question dealt with the extent to which media channels would be good predictors of the risk perception of the 2011 Fukushima nuclear accident. Even when controlling for five background variables, some communication channels emerged as significant predictors of risk perception. Television and interpersonal communication were both related to higher risk perception, while various minor online sources (with YouTube as probably the most important one) were related to lower risk perception.

Television was the most widely used medium to inform oneself about the accident. As many as 93.4% of the valid respondents identified television as an important medium for informing themselves, and for approximately one in four, television was the only medium they named as an important information source. As Sugimoto et al.<sup>(9)</sup> concluded, television is a ubiquitous medium and a great way to provide information to the public. However, in contrast to what Sugimoto et al. found in Japan, television use was significantly related to higher risk perception.

Frewer, Rowe and Sjöberg<sup>(18)</sup> assumed that any impact that television has on risk perception

would most likely be through the availability heuristic. However, television was the only media channel not significantly correlated with duration of attention paid to the coverage. Even if there was significantly more coverage on television news, the public did not seem to have paid attention to it for a longer time, compared to those for whom television was not a major source of information. As such, the availability heuristic cannot explain this result. Coleman<sup>(10)</sup> assumed that it might be the visuals and structure of television news that cause heightened risk perception: the more vivid presentation and the less in-depth content (compared with written reports) could convey greater danger to the public.

An alternative explanation could be the possible unique characteristics of the group of respondents who did not identify television as a major source of information. For example, Henning and Vorderer<sup>(19)</sup> found that students with a high need for cognition watch less television. People with a high need for cognition will also be more motivated to think, and thus, to base their opinion on factual information. This will possibly make them less dependent on heuristics, similar to what Yim and Vaganov<sup>(7)</sup> argued the effect of education could be.

Interpersonal communication was significantly correlated with both satisfaction with the media coverage and the duration of attention paid to it, and it was a significant predictor of risk perception. The influence of interpersonal communication on risk perception is in line with previous research. (e.g., 10)

The significant negative relationship between the miscellaneous online sources and risk perception is hard to explain, especially due to the vagueness of the category. Given YouTube's prominence online, it is quite likely that it was the most important component in this category. While even entertainment can increase risk perception<sup>(27)</sup>, this does not seem to be the case with YouTube, perhaps because YouTube clips differ greatly from traditional videos.<sup>(25)</sup> Unfortunately, the present study can only indicate the possible importance of YouTube.

The lack of effect of newspapers on risk perception is perhaps attributable to the balanced reporting on the subject. Media content analyses of the Belgian press revealed that a majority of newspaper articles were neutral towards nuclear energy. This was the case both for the first two months after the accident<sup>(17)</sup> and a year after the accident.<sup>(32)</sup>

Radio failed to reach significance as a predictor of risk perception, even though it was an important predictor for fear of social disruption in Japan. Sugimoto et al.<sup>(9)</sup> attributed their results to the position that radio holds as a central element in an individual's disaster plan in Japan. In Belgium, however, more people assume they would use television in case of a nuclear emergency, compared to radio.<sup>(15)</sup> Apparently, radio does not hold the same function as the central risk communicating channel, which could explain the lack of effect. Alternatively, the difference could also be related to the observation that the respondents were not directly affected by the nuclear accident, whereas the respondents of Sugimoto et al. all lived fairly close to the nuclear power plant in Fukushima. A third possible explanation could be the lack of visuals when compared to television. Even though radio news is similar to television news with respect to its linearity and structure (brief segments that are too short to give a broad context of the disaster), visuals are one major aspect in which it differs.

Finally, the Internet was not a significant predictor of risk perception, possibly because of its heterogeneous nature. While Internet use was significantly positively correlated with the duration of attention paid to the news about the Fukushima nuclear disaster, there are large differences between the various online sources.

Even though a great deal of research has been conducted on Twitter use during and after the 2011 Fukushima nuclear accident, the studied population did not use Twitter as an important information source at that time, and Facebook was not widely used either. Sugimoto et al.<sup>(9)</sup> found similar results in Japan. They assumed that their results were due to the composition of

their sample (64% of which was over the age of fifty), but this does not seem to be the case in the present study. Perhaps the rather low usage was due to the audience not perceiving social media as being as credible as newspapers<sup>(14)</sup>, for instance.

In conclusion, some media channels are indeed significant predictors of long-term health-related risk perception: television, interpersonal communication and miscellaneous Internet sources do have an influence on how the risk was perceived. Combined with the significant predictive power of satisfaction with the media coverage, it is evident that the media indeed play a role in shaping risk perception.

### **5.1. Other Predictors of Perceived Risk**

Contrary to what the first hypothesis predicted, duration of attention paid to the primary media channels actually had a (small but statistically significant) negative correlation with risk perception. While it failed to reach significance in the regression analysis regarding online media channels, the results of both analyses point in the same direction: people who paid attention to the news for a longer period of time had a lower risk perception of the accident. Wählberg and Sjöberg<sup>(29)</sup> suggested a possible explanation: if the amount of media coverage decreases, so does risk perception because the risk loses its “accessibility” in the minds of the audience’s members. Cantone et al.<sup>(17)</sup> noted that there was a significant decrease in the number of articles published regarding Fukushima, even in the first nine weeks after the accident. Just two Belgian newspapers published over 180 articles in the month following the accident<sup>(17)</sup>, while at the time of the data gathering, all Belgian newspapers together published 196 articles related to Fukushima. While this is still a fair amount, it does indicate a decrease in coverage.

People who did not find the information satisfactory were more likely to have a higher risk perception of the accident, in accordance with the second hypothesis and previous research.

Additionally, they were also more likely to engage in interpersonal communication about the matter, which was also significantly related to heightened risk perception. This could indicate that people turned to each other and listened to the rumours that appeared in order to reduce the uncertainty that the (unsatisfactory) official information created.<sup>(34)</sup> Two other media channels came close to being significantly related to satisfaction with the information: blogs and the websites of (non-)governmental agencies.

The third hypothesis received limited support, with only attitude towards nuclear energy being a significant predictor in both analyses. Gender and education each reached significance in only one analysis.

Attitude towards nuclear power was the most powerful predictor of risk perception of the Fukushima nuclear accident. Proponents of nuclear energy perceived the risk of the accident to be lower, while opponents deemed it to be higher. This result lends support to the hypotheses of Sjöberg<sup>(37)</sup>, Katsuya<sup>(35)</sup> and Siegrist and Visschers<sup>(36)</sup>: proponents and opponents are likely to interpret a nuclear accident differently, in such a way as to fit with their previous held beliefs and attitudes.

Education was the second most influential predictor for risk perception in the first regression analysis and it approached significance in the regression analysis for online channels. Education did seem to have an influence on risk perception: people with a higher level of education had a lower risk perception of the Fukushima nuclear accident, compared to those with a lower level of education. This result supports the findings of Whitfield et al.<sup>(2)</sup> The concrete dynamic behind this finding is unknown, however, as the literature offered many different explanations.<sup>(cf. 7, 28, 41, 44)</sup>

Gender was not a significant predictor of risk perception for the primary media channels, while the literature suggested it could be. Possibly, the gender difference in risk perception of an

actual nuclear accident only appears in areas close to the site of the accident. Tateno and Yokoyama<sup>(13)</sup> found that a significant difference in anxiety between mothers and fathers only appeared in the Fukushima prefecture, but not in the rest of Japan. Drottz-Sjöberg and Sjöberg<sup>(39)</sup> also found a significant gender effect in Sweden after the Chernobyl nuclear accident, bearing in mind that Sweden was one of the countries particularly affected by the accident.<sup>(4)</sup> Even when respondents are asked questions regarding their fear of nuclear power technology or of a hypothetical nuclear accident, Brody<sup>(38)</sup> noted that the gender difference is more outspoken for the local items, compared to the general items. Perhaps Belgium is located too far away from Fukushima to have outspoken gender differences in the general population.

In the analysis regarding online sources, however, gender did become a significant predictor of risk perception, with women perceiving the risk to be significantly higher than men. A possible explanation for this difference can be extracted from the study by Drottz-Sjöberg and Sjöberg.<sup>(39)</sup> They found that young men were the least risk averse group. In the present study, the group that used the Internet was indeed significantly younger (year of birth:  $M = 1972.75$ ,  $SD = 14.93$ ) than the group that did not ( $M = 1961.61$ ,  $SD = 17.30$ ),  $t(603.474) = -9.956$ ,  $p < 0.001$ . Perhaps the difference is a result of the significantly lower risk perception of the younger males that use the Internet.

## **5.2. Practical Implications**

The results can provide some practical guidelines for risk communicators. First and foremost, the results clearly show that media channels are not simple equivalents and communicators should be careful in considering which media channel to use. Social media were not widely used to gain information about the nuclear accident in Fukushima. The public still preferred traditional media as their go-to source for information. Given the finding that traditional media coverage is often

echoed in social media<sup>(12)</sup>, the traditional media should still be the focus of risk communicators. Television requires the most attention, as it was both widely used and significantly related to higher risk perception.

Those who are not satisfied with the information most likely turn to interpersonal communication, blogs and/or the websites of (non-)governmental agencies. These last two sources could help risk communicators in providing information to those who were dissatisfied with the mainstream coverage. Blogs could “translate” the coverage into more understandable messages, enabling more people to make sense of the situation. The websites of (non-)governmental agencies could provide the public with large amounts of information, which people could use to draw their own conclusion. In this way, more people will be able to find information tailored to their needs and they will probably be more satisfied with the coverage, with lowered risk perception as a result.

### **5.3. Limitations and Future Research**

Although the data set used in this study was representative of the adult Belgian population, it still had some limitations. Firstly, since not all factors could be controlled for, the results of the regression analyses cannot be interpreted as conclusive indications of causality. As the media use of 2011 predicted the risk perception in 2013, this correlational data can nevertheless provide some time ordering. A longitudinal study would have provided more definitive clues on causality, but because of the unpredictability of nuclear accidents, it is very difficult to gather a representative data set of this size before and after the accident. Secondly, in this study, it was not possible to control for how much exposure a respondent had to the channels in absolute terms. Next, it is possible that it was the (amount of) content on a channel and not the channel as such that altered risk perception. Therefore, future research could look into the quantitative and

qualitative differences in content between different media channels. Furthermore, the fact that the data were gathered over two years after the accident could also be considered slightly problematic. For example, Tateno and Yokoyama<sup>(13)</sup> thought that changes in perceptions would have disappeared if they conducted their study more than a year after the accident. However, this study still yielded several significant results, indicating that the effects on risk perceptions are quite resistant to change.

Finally, since YouTube is the third most accessed Website worldwide, it seems warranted to include YouTube as a separate option in questions regarding media usage and choice in future studies. The use of “miscellaneous online sources” significantly decreased the risk perception of the Fukushima nuclear accident. While YouTube is probably the major component of this category, its influence can never be truly known if it is not studied as a separated category.

## 6. CONCLUSION

The results of this study demonstrated that some media channels did have a significant influence on long-term risk perception. This is remarkable since the analysis controlled for five variables, most of which were also (highly) significant predictors.

The attitude towards nuclear energy was the strongest predictor of perceived risk, with people favourable towards nuclear power perceiving less risk. People with higher education also had lower risk perception, as did people who were very satisfied with the media coverage. The media channel will not cause people with low risk perception to suddenly experience high risk. In this sense, media channels are indeed not major factors in determining risk perception.

However, the other significant predictors are all rather stable variables: attitudes towards nuclear power are difficult to change, and evidence suggests that even after a nuclear accident, attitudes quickly bounce back to pre-accident levels.<sup>(36)</sup> Raising the educational level of a population is certainly possible, but it requires time and effort. The same is true for satisfaction with the media coverage: although it is perfectly possible for journalists and risk communicators to improve their messages to better suit the needs of their audience, this will not happen overnight.

In comparison, which media channel one uses is something that is more volatile. Of course, there are practical limitations that prevent everyone from having access to *all* media channels. However, as the results demonstrated, most people already use more than one medium to get informed. Depending on which medium gets the most weight in a person's media mix, their risk perception might change. Although this change would be subtle at best, it is still remarkable that such a minor difference can indeed significantly influence risk perception.

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## APPENDICES

**Table V: Bivariate Correlations between Primary Media Channels and Satisfaction/Duration**

	Duration	Satisfaction	Television	Radio	Newspapers	Internet	Interpersonal communication
Duration	1						
Satisfaction	-0.071*	1					
Television	-0.006	0.021	1				
Radio	0.140**	-0.033	0.043	1			
Newspapers	0.196**	0.042	0.136**	0.312**	1		
Internet	0.187**	-0.026	-0.082*	0.185**	0.219**	1	
Interpersonal communication	0.113**	-0.113**	0.034	0.189**	0.135**	0.209**	1

\*\* $p < 0.01$ , \* $p < 0.05$

**Table VI: Bivariate Correlations between Online Media Channels and Satisfaction/Duration**

	Duration	Satisfaction	Newspaper sites	TV/Radio sites	Agencies' sites	Twitter	Facebook	Blogs	Other
Duration	1								
Satisfaction	-0.071*	1							
Newspaper sites	0.085	-0.029	1						
TV/Radio sites	0.039	-0.036	0.036	1					
Agencies' sites	0.175**	-0.114	0.094	0.290**	1				
Twitter	-0.066	0.027	0.035	-0.001	0.090	1			
Facebook	-0.158**	-0.034	-0.029	0.025	0.031	0.252**	1		
Blogs	0.194**	-0.117	-0.162**	-0.127*	0.021	0.121*	0.086	1	
Other	-0.015	-0.011	-0.252**	-0.024	-0.054	-0.057	0.036	0.143*	1

\*\* $p < 0.01$ , \* $p < 0.05$