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REPORTING RISK

Media coverage of radioactivity and its health implications in the
Fukushima nuclear disaster

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Introduction

The purpose of this study is to examine how journalists should report the risk of radiation exposure when reporting on a serious nuclear accident. 'Risk' is usually defined as a situation involving exposure to danger. In other words, 'risk' represents the possibility of encountering danger, but it also describes a situation that exists before something dangerous happens. Journalists are generally attracted to fact-based news and tend to dislike this ambiguity. In the light of this view, it is clear that media reporting is likely to avoid reporting on risks in the sense of the possibility of something bad happening.

In the case of a nuclear accident, journalists have to face up to the probability and uncertainty of the health risks related to low-dose radiation exposure, an area in which scientific consensus has changed since the dawn of the nuclear age in 1945. For that reason, a journalist who is news-gathering at the scene, especially an inexperienced journalist, will tend to follow the newsroom's decision and underestimate risk rather than overestimating it. However, in the case of a nuclear accident, it is necessary for the media to conduct an analysis and report the risk of radiation exposure by supposing a worst-case scenario. In this essay, I would like to make this point clear.

This case study deals with the Fukushima Daiichi nuclear power plant catastrophe. The accident at the Fukushima plant occurred in the aftermath of the magnitude 9 earthquake and 15 metre tsunami on 11 March 2011, which devastated north-eastern Japan. The power supply and emergency generators for cooling the reactors at Fukushima were destroyed by these natural disasters. This led to a series of events that triggered core meltdowns in three reactors and hydrogen-air explosions in four reactors.

The International Atomic Energy Agency (IAEA) rated the Fukushima disaster as a Level 7 event, the highest level of the International Nuclear Event Scale and equal to the 1986 Chernobyl nuclear accident. According to the Tokyo Electric Power Corporation (TEPCO), the utility that runs the plant, at least 900,000 terabecquerels of iodine-131 was released into the air and contaminated the atmosphere around much of east Japan and the surrounding Pacific Ocean.

As a journalist belonging to a Japanese news agency I have reported the ever-changing situation of the Fukushima nuclear plant and the evacuation of residents since 2011. On the basis of this experience, I started to focus on how difficult it is to write articles describing the health impact of radiation exposure. For example, I interviewed experts who pointed out the possibility of a health hazard but when I submitted the article the news editor rejected it on the grounds that it might cause a panic in Japanese society.

The media, in its role of providing news to the general public, has a long-standing duty to report risks. In terms of articles dealing with the risk of health and environmental effects, the media performs differently. Especially in the case of nuclear accidents, the media struggles to handle the concept of risk. Taking advantage of the invisible and unnoticeable nature of radioactivity released into the atmosphere, the power company tends to underestimate the impact of the accident (Japan Times 2014). In order to avoid such a situation, the media has a duty to accurately report risks, including the effects of radiation exposure, by using specialists to analyse nuclear industry and government announcements. As a result, the media can play a role in preventing or minimizing health damage.

Methodology

Chapter 1 presents a summary of several theories relating to the perception of risk. Although it is difficult to cover the details of these concepts here due to space limitations, it is important to appreciate the relationship between media coverage and risk perception. The media coverage of risk certainly relates to risk communication in the field of public health and risk management.

This chapter also describes the basic features of risk in nuclear disasters. Nuclear power generation has been advertised as a clean energy source for a low-carbon economy, but once a leakage of radioactivity or a plant meltdown or explosion happens, its impact is immeasurable. The released radioactivity is carried on the wind and also remains on the ground for tens of thousands of years. Its harmful nature is internationally recognized and the relationship between cause and effect has been demonstrated by an increase in some diseases such as thyroid cancer in children. The 1986 Chernobyl accident was certainly the biggest nuclear disaster before Fukushima, and there are many research reports about its health and environmental impact. A knowledge of Chernobyl is fundamental for journalists reporting nuclear accidents, and provides a good example of familiarization with the risk of nuclear disaster.

Chapter 2 examines how the media dealt with risk in the coverage of the Fukushima disaster, in the form of a case study. Although this accident happened in Japan, which is considered to be a technological superpower, TEPCO (the owner of the nuclear power plant) failed to perform appropriate risk communication (Endo, p123). In terms of risk communication, although journalists reporting the accident adopted a scientific approach by citing the example of Chernobyl, the Japanese media seemed unable to report the risk properly to their readers. Rather they reported, without criticism, the government's affirmation that the accident was not serious and presented no immediate risk to health.

It is worth trying to confirm whether coverage by the Japanese media was appropriate in terms of communication, particularly in the early stages of the Fukushima disaster. The Japanese mainstream media normally employs few science journalists. When the accident happened, many of the journalists who were sent there were young and inexperienced with little scientific knowledge. As a result, in some published articles the differences between external and internal exposure were misunderstood, as I will explain in chapter 2. Looking at the media coverage as a whole, there were also some cases where risk communication failed. For instance, some broadcasting companies deliberately appointed experts who supported the government's view that the accident was not serious (Yamada, p48).

In the coverage of a nuclear disaster, which is a situation of probabilistic uncertainty, the media needs to examine announcements from the government and the power company carefully, and tell the audience what is happening at the plant and what is the risk of radiation exposure. However, the Japanese mainstream media has its 'press club' (kisha club) which is a unique system allowing direct access to the power industry. The relationship between the media and the power industry in Japan is stronger than in other countries, so it is not easy for a journalist to write an article opposing the government view. Bearing this in mind, it is important to look at how the Japanese media dealt with risk management.

I will also focus on how foreign media reported the Fukushima accident. German media continues to report the seriousness of the accident, unlike British media. Like Japan, the UK uses nuclear energy with the aim of reducing carbon dioxide emissions. Even after Fukushima, the British government and media are still promoting the use of nuclear energy. It is therefore interesting to compare the media coverage in Germany and the UK. I have recently interviewed science journalists and academics in both countries, focusing on the importance of risk perception in the media coverage. Due to limitations of space, it is not possible to include detailed analysis of the news content in the media of these two countries.

In Chapter 3, the concepts of risk management, risk communication, and the need for journalists with a scientific background in the coverage of a nuclear disaster are addressed. The Fukushima nuclear accident happened in Japan, a country with advanced science and technology and established freedom of the press. However, once the accident occurred, the government and the power company controlled information in the confusion and failed to disseminate information appropriately (Japan Times, 2014). The media was afraid to start a panic and tended to underestimate risk in their coverage, although their role was to explain properly the risks that residents faced and challenge the information from the power company.

It is understandable that reporting risk in a severe nuclear accident is difficult even for experienced journalists. On the basis of my personal experience of covering the Fukushima accident and the results of my interviews with experts, I wish to point out that it is important for journalists to disseminate information appropriately in order to protect the population from radiation exposure.

Brief summary

Five years have now passed since the accident at the Fukushima nuclear power plant. Although the Japanese government has tried to stress that the accident is being resolved, the road to resolution is still long and unexplored. Moreover, there has been an increase of child thyroid cancer in Fukushima (JIJI PRESS, 2016) and a relationship with exposure to radiation is suspected.

In respect of the Japanese media coverage of the Fukushima accident, my conclusion is that information from the government and power company which insisted that the impact of the accident was minor was highlighted, but information from other sources which pointed out its danger and seriousness was not. In the coverage of a nuclear disaster, journalists have to understand what residents most want to know. They need information to assess whether they need to evacuate the area. In the reporting of the Fukushima accident, it is noticeable that journalists did not have the right approach to cover the story about risks in a multi-faceted way.

This study focuses on how journalists should report on risk in nuclear accidents. The concept of risk communication or risk management is important for journalists reporting on a stochastic and uncertain situation such as a nuclear disaster. In order to communicate risk to their readers, journalists have to develop a broad range of scientific knowledge.

Chapter 1: Risk management in journalism

1.1 Definition of risk

The concept of risk is in close contact with the daily life of humankind and cannot be separated from us, appearing at every corner in our lives. Paul Slovic and Elike U. Weber (2002, p. 4) describe this concept:

It contains elements of multidimensionality and subjectivity that provide insight into the complexities of public perceptions. The fact that the word 'risk' has so many different meanings often causes problems in communication. Regardless of the definition, however, the probabilities and consequences of adverse events, and hence the 'risks', are typically assumed to be objectively quantified by members of the risk assessment community.

Risk exists as a reaction to human physical behaviour or action. For example, when you drive a car, you have a risk of getting into an accident. Even if you take care of your health on a daily basis, you have a risk of becoming ill. Consciously or not, we qualitatively determine the risk in our approach to each one of these actions and collect information in order to avoid the risk. Because we constantly live with risk, we develop our own risk management ability. Slovic (1987, p. 280) explains the need for this ability:

The ability to sense and avoid harmful environmental conditions is necessary for the survival of all living organisms. Survival is also aided by an ability to codify and learn from past experience. Humans have an additional capacity that allows them to alter their environment as well as respond to it. This capacity both creates and reduces risk.

In our everyday life we grasp risk intuitively, rather than quantitatively. That is why it is important for individuals to have their own risk perception. In order to recognize risk, we have to know the possibility that risk becomes apparent. For example, Kazuto Suzuki defines risk as:

$$\text{Risk} = \text{Likelihood} \times \text{Size of impact}$$

He explains that this definition indicates that risk involves not just the question of likelihood but also the significance of the impact and its consequences. This formulation shows two ways of reducing the risk of major damage. One is to reduce the likelihood of certain things happening (risk mitigation) and the other is to reduce the impact of an accident should it happen (damage control).

This formula is important in recognizing and communicating risk. The ability to visualize risk has a huge impact on how people decide to act in order to minimize damage. In a serious disaster, any delay in judgement can be a matter of life and death. For example, the Great East Japan Earthquake

of 11 March 2011 caused a huge tsunami in the north-eastern coastal areas. Although the Japan Meteorological Agency issued a tsunami warning and local administrations called for evacuation, the tsunami rushed to land more quickly than expected and caused the loss of life of more than 14,000 people. In 1896, in this same area, a huge earthquake took the lives of more than 20,000 people. From historical knowledge and the characteristics of earthquakes, which occur with a certain degree of periodicity, we know that people living in this area are subject to a relatively high risk of severe earthquakes and tsunamis.

1.2 Reporting risk in a nuclear accident

In such a large-scale disaster or accident, particularly a nuclear emergency, one of the greatest needs is risk communication. An accident which releases harmful but invisible radioactivity causes problems for health and the environment, and the fear of radiation exposure has a great impact on people.

The IAEA defines a nuclear accident as 'any accident involving facilities or activities from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State' (p. 12). Historically, several large-scale accidents have occurred such as Windscale (UK, 1957), Three Mile Island (USA, 1979), Chernobyl (Soviet Ukraine, 1986), Tokai Mura (Japan, 2000), and Fukushima (Japan, 2011).

Although nuclear power has been touted as a clean energy source suitable for a low-carbon society, it has increased the exposure of the public to discussion about the risks of nuclear power.

According to the results of Slovic's studies of the perception of risk, nuclear power has been a frequent topic of such analyses because of the dramatic opposition it has engendered in the face of experts' assurances of its safety. Nuclear risks occupy extreme positions in psychometric factor spaces, reflecting people's view that these risks are unknown, deadly, uncontrolled, inequitable, catastrophic, and likely to affect future generations. In addition, Slovic explains that because nuclear risks are perceived as unknown and potentially catastrophic, even small accidents will be highly publicized and may produce large ripple effects (1987, p. 285).

To emphasize this point, we need to look at the important role of the media. The media can take an invisible problem and make it visible, so that the public realizes what risk will ensue. For example, when you see a nuclear power plant exploding on TV, the risk of what might happen in the future becomes obvious. The media therefore have a strong influence on public risk perception and play a central role in risk communication (Perko, p. 388).

This makes it essential for journalists to understand scientific language well enough that they can report accurately without causing misunderstanding. The first important point is the current state of the accident. Journalists have to report what the government, the plant owner, and scientific specialists say about the occurrence of meltdown and hydrogen explosions, and whether the evacuation of residents is required or not. The second point is a knowledge of radiation exposure. The United Nations Scientific Committee on the Effect of Atomic Radiation (UNSCEAR) provides the following background information for journalists:

The main exposure pathways in the assessment of doses to the public are: (a) external exposure from radionuclides in the air and deposited on the ground; (b) internal exposure from inhalation of radionuclides in the air, and (c) internal exposure from the ingestion of radionuclides in marine and terrestrial foodstuffs, and water. Radioactive isotopes of caesium and iodine are recognized as significant in terms of potential health and environmental impact after a major nuclear accident. For internal exposures, an important contribution is from the ingestion and inhalation of isotopes of iodine and caesium. In the early days after the accident, a primary concern was the exposure of children to radioactive iodine through inhalation and ingestion (UNSCEAR, p. 2).

A nuclear disaster can happen unexpectedly anytime, anywhere. In a massive disaster, not only specialist science journalists but also young and less experienced journalists have to join the investigative reporting team. That's why the scientific language of the health effects of radiation exposure should be part of a journalist's basic knowledge before a disaster happens. Any articles distributed by the media contain a risk communication message for the public.

Chapter 2: The Fukushima nuclear catastrophe

At 2:46 pm on 11 March 2011, the Great East Japan Earthquake with a magnitude of 9.0, the fourth strongest in the world since 1990, happened near the east coast of Japan. Immediately after this, a huge tsunami hit the coast around the Tohoku region including the prefectures of Miyagi, Iwate, and Fukushima. According to the National Police Agency, the death toll up to 10 March 2016 has reached 15,894 and the number of missing persons is 2,561. The Great East Japan Earthquake is one of the worst disasters not only in Japan but also worldwide.

To add to the scale of the catastrophe, this gigantic earthquake and tsunami triggered a nuclear disaster. The Fukushima Daiichi nuclear plant is located on the Pacific Ocean coast of Fukushima prefecture, within 200 kilometres of Tokyo, the capital city of Japan. The earthquake and tsunami destroyed the power supply facilities and the emergency generators for cooling the reactors at the plant. As the result, although workers at the plant did their best to stabilize the situation, for example by implementing a venting procedure which reduced the internal pressure of the reactors, core meltdowns occurred in three of the reactors and hydrogen–air explosions in four of them. This sequence of events – earthquake, tsunami, and nuclear accident – became Japan's 'triple disaster'.

As a result of venting and explosions, according to the data released by TEPCO, at least 900,000 terabecquerels (Tbq) of iodine-131 and 15,000 Tbq of caesium-137 were released into the air (JIJ Press, 2012). The Japanese government has admitted that the amount of caesium-137 released was 168 times that of the atomic bomb dropped on Hiroshima. A plume containing a high concentration of radioactive material flowed around the Tohoku and Kanto areas, including the Japanese capital Tokyo where central government and major institutions are concentrated.

Considering these circumstances, it is important to know how the Japanese government reacted at the time. The government decided to evacuate people within a radius of 20 kilometres from the nuclear plant, although its instructions were released little by little.

At every media conference the then Chief Cabinet Secretary Yukio Edano repeated the statement that 'radiation levels would not have an immediate impact on human health' in order to avoid excessive reaction from the public. However, as mentioned above, large areas of the country were highly contaminated by radiation released from the Fukushima plant. In Fukushima prefecture itself, one worrying trend is the increased incidence of childhood thyroid cancer. A thyroid cancer survey in Fukushima prefecture announced by Fukushima Health Management Survey on June 2016 found 173 young people with confirmed or suspected cancer, although a panel of experts maintains the view

that the cancer was not caused by radiation from the nuclear accident. It should be emphasized that this evidence is more compelling because such an increase in cancer has not been reported previously.

In Japanese society, although public expressions of anxiety such as worrying about radiation exposure or how residential areas are contaminated are avoided, nearly 100,000 people are still evacuated from the local area more than 5 years later and the accident still casts a dark shadow over Japanese life.

Plans for the clean-up of the nuclear accident are also progressing very slowly. Although TEPCO wants to decommission the Fukushima reactors in 30–40 years, this is not going exactly as planned (JIJI PRESS, 2017). A high concentration of contaminated water has continued to leak from the plant into the ocean, and TEPCO is struggling to keep within radiation exposure limits and ensure the workers' safety. In September 2013, while supporting Tokyo's bid for the 2020 Olympic Games to members of the International Olympic Committee in Buenos Aires, Prime Minister Shinzo Abe said that the problem of contaminated water leakage was 'under control'. However, the problem is not resolved at all even 5 years after the accident and the reactor decommissioning plan is bogged down (JIJI PRESS, 2017).

2.1 How Japanese media reported the accident

In this section, I examine how Japanese media reported the accident from the viewpoint of risk management. The Fukushima catastrophe happened as a result of a huge earthquake and a tsunami of unimaginable proportions. It is only natural that the media responded desperately among the confusion, but they have a big lesson to learn about risk management for journalism.

First, I need to define the term 'Japanese media'. In Japan, there is an institution called the kisha club (press club), to which mainstream media such as newspapers, news agencies, and TV stations are exclusively affiliated in order to report public institutions and organizations. Major media companies affiliated to it are newspapers such as *Asahi*, *Yomiuri*, *Mainichi Nikkei*, and *Sankei*, news agencies such as Kyodo and JIJI, and TV stations such as NHK and commercial companies. In this paper, I use the term 'Japanese media' to refer to these mainstream media.

In the coverage of the Fukushima catastrophe social media emerged as an important and wide-ranging source of information, but in this paper I focus mainly on the mainstream media coverage because of its role as the main source providing information to Japanese society.

The coverage of a nuclear catastrophe is totally different from other situations such as describing the damage done by an earthquake or predicting the risk of a tsunami. Covering a story about a risk that

cannot be perceived, such as radiation exposure, is particularly difficult. At Fukushima, with limited access to the unstable nuclear power plant which was at risk of exploding, sources of news were limited to the government and TEPCO, the power company that operated the plant. But there's evidence that TEPCO released information that underestimated the severity of the situation in order to obscure the location of responsibility (Japan Times, 2014).

Nuclear accidents are rare, and local residents are likely to have no previous knowledge or experience of radiation exposure or the possible outcomes of the accident. They rely on the media for information. Immediately after the Fukushima accident, therefore, the role of the media was to be a link for transmitting readily understandable information from the government and TEPCO to the residents. Risk communication is important, even in serious situations where there may be little information, or conflicting information. The media has an obligation to report up-to-date information openly, explaining the terminology clearly, so that the evacuation of residents can proceed smoothly.

Regrettably, in the confusion following the Fukushima accident the Japanese media could not analyse information accurately. The historical background is that Japanese mainstream media has not placed much emphasis on professional science reporting. They therefore found it difficult to analyse the scientific information issued by the government and TEPCO after the Fukushima accident. They could not even provide enough information for residents to reduce their exposure risk. We saw tragic situations such as a mother with her children exposed to radiation from radioactive material that was pouring from the sky while they waited in the open for the distribution of water.

In the case of a serious nuclear accident, it is fundamentally important for the media to communicate information about risks to residents to allow them to reduce their risk exposure, and it is therefore worth trying to examine how the Japanese media reported these risks.

2.2 Criticism of 'announcement journalism'

The Japanese mainstream media have been criticized for practising 'announcement journalism', which means they did not play a watchdog role, although they eagerly reported the damage from the earthquake and tsunami. For reasons explained above, such as a lack of specialized science journalists, the Japanese media did not function properly and acted like a public relations department for the government and TEPCO. As Kaoru Endo (2012) described it:

When the nuclear disaster happened, it shed light on the lack of science journalists with media expertise. The media found it difficult to write articles providing appropriate judgement and commentary. For that reason, they passed on announcements from the government and

TEPCO just as they were, without any analysis. As a result, trust in the news has been lost. (p. 125, translated by Takahashi)

There is some evidence to demonstrate the existence of ‘announcement journalism’. In the early stages of the accident, while risk was increasing, then Chief Cabinet Secretary Yukio Edano repeatedly said that radiation levels ‘would not have an immediate impact on human health’. He said this in the same words at each press conference, and the media kept on reporting it without verification or criticism. In fact, at that time radiation had already been released to the air due to reactor meltdown and the venting of radioactive gas. Even when the government issued an evacuation order for residents living within a radius of 20 kilometres of the nuclear plant, Japanese TV continued to broadcast Edano’s message, adding that the evacuation was ‘just a precaution’, and hired commentators who fully supported the government. As a result, people tended to believe the information they were getting from the media and were exposed to radiation without being aware of it. This was a failure of risk communication for the media. Kenta Yamada (2013) insists that:

In spite of the situation of less accurate information, the media were not able to issue a sufficient warning about the danger of the nuclear power plant accident. The mainstream media had an opportunity to tell their readers about the dangers of risks from radiation in the immediate periphery of the nuclear plant by using sources such as freelance journalists. However, the media gave priority to information coming from the government. Announcement journalism led to results giving a false impression to the readers. (p. 127, translated by Takahashi)

We have to be careful here: this does not mean that the mainstream media altogether failed to point out risks. They dealt with the possibility of meltdown, the mass scattering of highly radioactive pollutants, and the risk of explosions. The problem was that government announcements were never critically treated, and the repeated reassurance at press conferences made a vivid impression on people. Yamada explained the background to the media giving priority to government announcements:

Especially in a national emergency, the media need to be able to rely on government announcements of the latest information and tend to rate their reliability higher than that of other news sources. This is authority journalism. When there is an overwhelming lack of information, the media are prone to give priority to government announcements as a reliable source. This can be described as a natural defence reaction, based on the long-standing mutual trust relationship between media and government. (p. 48, translated by Takahashi)

Here, it should be emphasized that the basic idea of risk communication is for all information to be open, with nothing hidden. As explained earlier, the media failed to provide proper risk

communication to their audience due to their lack of analytical skills for reporting the Fukushima disaster.

In such a confusing situation people believed what the government and TEPCO said in spite of the wide range of information available from social media, because of a 'myth of safety'. Suzuki explained that this myth of safety presupposed that the high standard of safety regulations and the excellent quality of Japanese technology were enough to ensure that nuclear power plants would be 100 per cent safe (p.62). Endo also states it as:

Most Japanese people believed that Japanese technology was the best in the world after the period of high economic growth. In the case of Fukushima, that's why people easily believed the statements from government and TEPCO insisting that the Fukushima accident was undoubtedly resolvable. When they explained that the Fukushima accident was not serious as the Three Mile Island or Chernobyl accidents, people took it for granted. When Chief Cabinet Secretary said 'perform the procedure immediately' in the press conference, I think it restored people's confidence that 'Japanese technology would never be beaten by a nuclear accident'. (2012, p. 124)

However, the Fukushima nuclear accident revealed that this myth of safety was indeed a myth. Once the myth was broken, people realized that dependence on technological solutions and a lack of preparedness meant it would be impossible to assure that there would be no further disasters of a similar kind (Suzuki, p. 62). Endo also explains that the reporting of the accident looked as if it was done on an ad hoc basis and seemed ineffective even to the untrained eye. This reflects not only a fear of nuclear accident but also a trust issue in Japan, in other words, an anxiety of Japanese identity (p. 124).

The remarkable rehabilitation of post-war Japan has attracted the attention of the whole world. Bomb-damaged areas turned into high-rise buildings in a few decades after the war. I think this experience may have become a spiritual support for the Japanese people and led to their trust in Japanese technology, based on the history of post-war rehabilitation and Japan's success in becoming a big economic power. This remarkable development created the myth of safety and set it at the heart of the nation. This myth has had a vast influence on a wide range of fields such as politics, economics, and the media. I conjecture that this forms the background to the Japanese media's obvious inability to cover the nuclear disaster in a straightforward manner.

The Japanese mainstream media were not quick enough to rid themselves of the myth of safety, although the general public had already ceased to believe it. Some newspapers, such as the *Tokyo Shinbun*, insisted on the abandonment of nuclear power generation and showed a clear direction but

most of the mainstream media belonging to the kisha clubs only began to consider a change of policy. The eyes of the people saw the media in confusion due to their strong reliance on their relationship with government, and people seemed to feel that was why the media could never be critical of official policy. As a member of the profession belonging to the mainstream media, I am not in a position to criticize. The Fukushima nuclear accident left a number of challenges for Japanese media.

Five years after the Fukushima accident, mainstream media such as *Asahi Shinbun* have been examining the news stories of the time. These reviews reveal problems the media faced at the time of the nuclear disaster and are useful information for foreign media. As explained earlier, it was important for the media to provide accurate information, namely that residents should evacuate as soon as possible in order to avoid radiation exposure. On the other hand, government and TEPCO tended to underestimate the impact of the accident. For that reason, the media have a role in facilitating communication from government and the plant owner to residents.

2.3 Comparison with the coverage by British and German media

It is interesting to focus on the foreign media coverage of the Fukushima disaster. The Japanese population wanted as much information as possible about the current situation of the plant and were frustrated by the Japanese media. The spread of social media helped people to access useful information which was openly reported in the foreign media, such as the direction and flow of the radioactive plume.

It is clear that the Fukushima accident had a huge impact on many countries. At that time, there was a possibility that human health beyond Japan might be affected by leaked radioactive effluents, and coverage was complicated due to the lack of information coming from Japan. The disaster also had a significant impact on energy policy worldwide; some countries like Germany or Switzerland declared a change from the promotion of nuclear power to an anti-nuclear policy. In such a situation, it is important to examine the context of the foreign media coverage, focusing on that of German and British media. The reason for choosing these two countries for comparison is that the UK operates a similar number of nuclear power plants to Germany and these countries have the same proportion of nuclear energy in their energy mix (Kepplinger & Lemke 2016, p.4).

The coverage of the Fukushima accident in the German media focused on the maximum risk of radiation exposure even at the very early stages of the accident. In particular, they pointed out the high possibility of meltdown at a time when the Japanese government and TEPCO had denied this. The German media insisted on the dangers of the Fukushima accident on the basis of their

experience of the 1986 Chernobyl disaster, and the German government quickly decided to change direction to an anti-nuclear policy.

By contrast, in my view, the British media adopted a more subdued tone, and tended to avoid sensational language. The reason may be that the geopolitical conditions in the UK are far removed from those of Japan, and the earthquake and tsunami that caused the Fukushima disaster are most unlikely to happen in the UK. Of course, the geopolitical conditions in the UK are much the same as in Germany, but experiences and memories of Chernobyl are probably more vivid in Germany than in the UK.

Although this study should ideally cover content from newspapers, TV, and news agencies, space is limited and it is not possible to cover all media. Instead, I refer to the article by Hans Mathias Kepplinger and Richard Lemke (2016) which compares the media coverage of Fukushima in four countries including Germany and the UK. They examined the comparison by using the theory of instrumental actualization: in mediated conflicts, the mass media tend to exaggerate events consistently with their editorial line (p. 1). They examined national daily newspapers, tabloid papers, weekly newspapers, and magazines from both countries (see Table 1).

Table 1: Media examined

	Germany	United Kingdom
National daily newspapers	Frankfurter Allgemeine Zeitung Süddeutsche Zeitung^b <i>Frankfurter Rundschau</i> <i>Handelsblatt</i> <i>Taz</i> <i>Die Welt</i>	The Times Guardian <i>Telegraph</i> <i>Independent</i>
Tabloid papers	<i>Bild</i>	<i>Sun</i>
Weekly newspapers and magazines	<i>Frankfurter Allgemeine Sonntagszeitung</i> <i>Der Spiegel</i> <i>Focus</i>	<i>Independent on Sunday</i> <i>Observer</i> <i>Sunday Telegraph</i>
Total	10	8

Based on Table 1 from Kepplinger & Lemke (2016).

Newspapers in **bold** were chosen for the comparisons.

This examination also focuses on the coverage provided in two comparable newspapers in each country. The *Süddeutsche Zeitung* and the *Guardian* take a more left-wing, liberal approach and the *Frankfurter Allgemeine Zeitung* and *The Times* a more right-wing, conservative approach. The interesting result was that the German newspapers (713 articles; 991 statements) gave the events in

Japan and their significance for their own country far greater coverage than the UK newspapers (212 articles; 261 statements). The newspapers in Germany also gave the Fukushima disaster itself more coverage than the UK papers (see Table 2).

Table 2. Fukushima accident: Number of articles in German and UK newspapers

Germany	United Kingdom
241	109

Based on Table 2 from Kepplinger & Lemke (2016).

According to Table 2, the German newspapers dealt with the Fukushima accident as the main topic in 241 articles, whereas the UK newspapers devoted only 109 articles to it. Kepplinger and Lemke also found that in connection with the Fukushima accident, the German newspapers covered nuclear energy in their own country to a greater extent than newspapers in the UK, publishing an extremely high number of these articles (211) compared to 20 articles in the UK newspapers (p. 8).

There are two reasons why the German media might be more energetic than the UK media in reporting a nuclear accident. One is the memory of the 1986 Chernobyl nuclear accident, when radioactive materials released from the explosion of the plant reached as far as Germany and caused real harm by contaminating food and soil. After this relatively recent experience it is natural that many Germans, including journalists, oppose the promotion of nuclear power. Therefore, not surprisingly, German newspapers reported promptly and energetically on German nuclear policy.

Another reason is the effect of political movements. After the Fukushima accident the German Green Party, insisting on an anti-nuclear policy, got 10% more votes than before. In response to this, the German Chancellor Angela Merkel announced on 29 May 2011 that all nuclear power plants in Germany would close by 2022. This announcement indicated that Germany had changed the direction of its energy policy from nuclear power to renewable energy. This policy reversal had an impact on journalists dealing with the aftermath of the Fukushima accident. The number of articles relating Fukushima to the German nuclear industry did not decrease but rather increased (p.8). Evidently, the German media had a clear reason to report the nuclear accident in Japan and their articles helped Japanese people who were having difficulty in finding enough information to help them decide whether to evacuate or not. This means that the news attitude of the German media, forcefully pointing out the dangers of the Fukushima disaster, provided better risk communication than the Japanese media.

By comparison with the robust reporting of the nuclear accident by the German media, the British media's response seems quite subdued, as the figures cited above indicate. I think this is linked to

the energy policy of the British government, which is bound to have an effect on the media. The background experience of Chernobyl was the biggest impact for the German media but for the British media there are no studies on media coverage of Chernobyl in relation to UK nuclear energy after 1986 (Kepplinger & Lemke,2016,p.4)

The environment surrounding the British media is similar to that in Japan. Before the Fukushima accident, both Britain and Japan were considering an ambitious expansion of nuclear power as part of their strategy to reduce carbon emissions (Poortinga, Aoyagi & Pidgeon, 2013, p. 1204). However, even after the accident, UK policy-makers remained fully committed to their decision to increase the share of nuclear power in the energy mix (Ibid., p. 1205). Of course, not all British media were in favour of nuclear power and they did not fail to report the Fukushima accident. In the early stages of the disaster, there were many articles pointing out its risk and potential dangers. Nevertheless, the British media was noticeably less forceful in reporting the implications of the Fukushima accident than the German media.

Chapter 3: A lesson for journalists from the experience of Fukushima

The Fukushima accident was an entirely unexpected event not only for Japanese journalists but for journalists all over the world.

Happening just 25 years on from the Chernobyl disaster, Fukushima had a big impact on peoples' fear of nuclear disaster. Additionally, I believe that the obvious confusion of the Japanese media's response can be seen as an important lesson for journalists. In this chapter, I propose to consider what journalists can learn from the Fukushima experience.

3.1 Knowledge of scientific terminology

In order to report a nuclear catastrophe, a journalist has first to gather as much high-quality and reliable information as possible from official government sources and the relevant authorities, in this case TEPCO who owned and operated the power plant. In order to avoid the risk of health effects from radiation, the most necessary information to obtain right away is the amount of radioactive leakage and the direction of travel of the plume of radioactive material. However, in the confused situation at Fukushima it was not easy even for experienced journalists to find a reliable source of this information, as the authorities directed attention away from the dangers of exposure. Journalists reporting on the Fukushima accident were hard pressed just to cover the press conferences, which took place in rapid succession: I had to cover about twenty press conferences by TEPCO in a day and struggled with the amount of information provided. Although my agency sent two or three journalists to cover the press conferences, sleep-deprivation and tiredness made it hard to maintain a consistent level of analytical thinking.

It was hard to analyse the information we were given scientifically and ascertain its truth without a basic knowledge of the science relating to nuclear energy and its health impact. When I look back at my experience, I have to admit that I did not have enough background knowledge for reporting at this time although I kept on try to find out more throughout my reporting.

News which is insufficiently analysed makes people anxious and increases the spread of baseless rumours. In the early stages of the Fukushima crisis, the Japanese media were confused, taken by surprise that a nuclear disaster had happened in Japan. As a result, what they reported in this serious crisis were announcements from the government and TEPCO, just as they were, without question.

As an essential preliminary for reporting nuclear catastrophe, the most important background knowledge is to learn from past accidents. Chernobyl is, of course, the worst nuclear disaster in the

history of nuclear power generation. The IAEA rated it as a Level 7 event, the same rating as Fukushima. At Chernobyl, the reactor exploded during a test operation, leading to core meltdown. A large amount of radioactive material was released into the atmosphere and contaminated many parts of the northern hemisphere. The area within a radius of 30 km from the plant was specified as an area of forced emigration and more than 100,000 residents had to leave their homes.

Although the operation of a nuclear power plant involves very complex science and technology, what a journalist has to report in the case of an accident is much simpler: the cause of the accident, the quantity of radioactive material released, and the prevailing weather conditions (direction of wind, etc.). The first and second of these present the greatest problems. It is difficult to find a reliable source at the very early stage of an accident, because government and the power company will tend not to divulge all information in order to avoid panic. Journalists have a duty to clarify the cause of an accident, and this will sometimes take a long time. However, the latest weather information is easily ascertained from specialist meteorological agencies. During the Fukushima crisis, a wide variety of weather information from foreign agencies was available via social media, although the Japanese media relied on information only from the Japanese Meteorological Agency. Journalists are required to react instantly in order to obtain the information required in a nuclear crisis. For that reason, elementary knowledge learned from past cases is important.

In a situation where information is complicated, it is not easy for journalists to start investigating the history of nuclear power and the health effects of radiation exposure. It is essential to be prepared and know something about these subjects in advance.

Another fundamental requirement is a knowledge of the effects of radiation exposure on health. There is an increased incidence of childhood thyroid cancer which WHO officially admitted to have a causal relationship with radiation exposure although an increase of diseases such as leukaemia and kidney disease has not yet been publicly recognized.

According to the website of World Nuclear Association, there are currently 447 operable civil nuclear power reactors around the world, and nuclear power is an important source of energy in many countries. But nowadays nuclear installations have become a potential target for terrorists as well as having a high risk of accident caused by natural disasters. Therefore news dealing with a nuclear accident is likely to be delivered suddenly.

Journalists have an important role in helping people decide whether to evacuate or not by speedy news reporting of the amount of radioactive material released and the wind direction, which indicates how the plume is dispersing.

For this reason, journalists need to understand the scientific terminology used to describe radiation, particularly the many different units used in the measurement of radiation exposure. First, there are units used in measuring the health effect of radiation on humans: sievert (Sv), millisievert (mSv), and microsievert (μSv). 1 Sv is equal to 1000 mSv and 1 mSv is equal to 1000 μSv . The sievert is a measure of radiation dose. Secondly, the becquerel is a unit used to measure the radioactivity of an amount of material. It is important for journalists to report both kinds of units and both of them are indispensable in expressing the seriousness of an accident. The unit most commonly used by the news media to measure the health impact of radiation is mSv. So every time you face the unit of Becquerel, you have to calculate it into mSv. For example, to calculate the impact to the human body having consumed food and drink containing 100 Bq Caesium 137, the formula is $100 \times 1.3 \times 10^{-5} = 0.0013 \text{mSv}$.

It is essential to tell readers how much radiation has leaked by giving the numbers in detail, but just stating the numbers is not directly meaningful to most people. This is why journalists tend to use the comparison of medical exposure to X-rays as an illustrative example. In the Fukushima crisis the Japanese media often used this comparison. Although this is an effective way to visualize the risk of radiation exposure, it is easy for journalists to make a mistake by failing to understand the difference between external and internal exposure. External exposure is being exposed to radiation that is outside the body, whereas internal exposure means being exposed to radiation within the body, as a result of breathing in or ingesting radioactive material. External exposure is similar to X-rays or natural radiation and it can therefore be meaningfully compared with medical exposure. However, internal exposure is more serious and comparison with medical exposure is not enough to point out the risk of this type of radiation exposure. Radioactive materials have a half-life, which means that their impact decreases as time goes on. Additionally, some radioactive material is released from the body by excretion. On the other hand, once radioactive material gets into the body it penetrates to various organs. As a result, health damage may only appear gradually.

In the Fukushima crisis, Japanese media reporting the dangers of radiation exposure focused on external exposure, apparently ignoring the seriousness of internal exposure. As pointed out earlier, this shows how unprepared the Japanese media were. In comparison, it is easy to see how much better prepared the German media were, on the basis of their Chernobyl experience. In Germany, there seems to have been a stock of knowledge and experience for both media and audience, as a result of Chernobyl. They already knew the seriousness of the health effects of radiation exposure. The German media therefore reported on a worst-case scenario for Fukushima from a very early stage of the accident, on the basis of expert scientific opinion, although the Japanese government

and TEPCO announced that the Fukushima plant was not in a serious condition and denied that meltdown was happening.

Jürgen Döschner, an experienced journalist for Westdeutscher Rundfunk who reported on the Fukushima disaster, explains it thus:

The position of German media and audience about nuclear disaster is that I am in a privileged situation, because most of our audiences you do not need to persuade. We here in Germany have a very long tradition of nuclear scepticism – not just in the media.

In other words, it can be said that Germany is ready to confront a nuclear disaster on the basis of their history of facing it at Chernobyl. In particular, media which have already known the seriousness of radiation exposure do not try to underestimate the impact of a nuclear accident. This explains why the German media could clearly point out the occurrence of meltdown while the Japanese government denied it.

Döschner is a journalist with considerable experience in the reporting of nuclear disasters. He has reported not only on Fukushima but also on Chernobyl and the Kyshtym disaster at Mayak, Russia, the third most serious nuclear disaster. He visited the Fukushima region twice in 2012. Döschner made many reports of the Fukushima crisis for public radio stations in Germany and online. Additionally, he mentioned that he encountered no censorship or restrictions of any kind on his reporting.

When we look at reporting by Japanese mainstream media, things are different. In my own case I have experienced self-censorship from the news agency I belong to, such as a refusal to publish articles on health hazard evaluation, and censorship could be the reason for such limited information being provided by government and the power plant authorities.

It may be no surprise that censorship or self-censorship happens when a nuclear disaster happens in one's own country. It is natural for a government to try to manage media information in order to avoid panic in case they are considering evacuation of a wide area or significant environmental impact. Therefore, though the situation differs from one country to another, even in a situation where there is censorship or self-censorship journalists should include the worst-case scenario in their reporting in order to provide appropriate and reliable information for people who are confused by the situation.

Lois Rogers, a British journalist who is the former health and social affairs editor of the *Sunday Times* (London), also reported on the implications of Chernobyl. She has a wide range of experience covering health, medical, and environmental issues and is restrained in her comments on the risk of radiation:

It is important to make clear that precise knowledge of health effects by radiation exposure is limited and there is disagreement among experts. My impression is that fears about long-term contamination have seemed to be less well-founded as knowledge of radiation effects has increased. For example, long-term health effects have apparently been less severe than was feared in Belarus after Chernobyl, but that may be because there is little local epidemiological research.

As Rogers points out, it is true that there is disagreement about the health effects of radiation and unclear even to specialists. Even 70 years after the atomic bombs fell on Hiroshima and Nagasaki, it is still difficult to come to a conclusion. Journalists should avoid biased reporting and should concentrate on level-headed coverage and information analysis in the face of scientific uncertainty. Objective coverage is always required of every journalist. Rogers's words indicate an important role for journalism, because false information can cause people to panic. In the Fukushima crisis there were a number of false rumours, especially spread by social media, although accurate information could be found there too.

In terms of reporting nuclear disaster, Rogers considers that journalists do not need specific knowledge in advance; rather, they can turn to expert guidance from international organizations and global authorities:

I don't think one can prepare specifically for reporting a nuclear disaster. To some extent it requires the same skills as are needed for reporting any major event. I now specialize in writing about health and life sciences, but I have also worked for many years as a reactive news reporter. In my capacity as a specialist, however, I would turn to expert guidance from the agencies of the United Nations, military health experts and other global authorities for informed comment and guidance on the likely or possible short- or long-term civilian effects of such a disaster.

Indications from these two highly experienced journalists emphasize the difficulty of reporting nuclear disaster. That is exactly what I experienced while reporting for local residents in Fukushima. Even in the situation where the nuclear reactors had exploded and a large amount of radioactive material had been released, journalists had to decipher vague and uncertain information from the government and TEPCO. Although journalists should ideally report on the basis of level-headed analysis and expert knowledge, in a sudden nuclear disaster a young or inexperienced journalist does not have time to prepare. Therefore, as Rogers emphasized, they should find out as much basic knowledge as they can from expert guidance.

3.2 The importance of social media

My experience has been that social media is a useful means of gathering appropriate information. Although a large proportion of news in social media consists of false rumours, there are also many valuable sources of information, historical data, and expert opinion. Blogs, Facebook, and Twitter are continually updated. In a confused reporting location, it is not easy to consult reference books but social media gives the journalist an opportunity to collect useful information, interview some specialists, and learn about reaction from other countries. I exploited social media in depth; for example, I was the first Japanese journalist to succeed in obtaining an interview with a Belarusian specialist who had performed autopsies on residents of Gomel, Belarus (a city which was seriously affected by the Chernobyl accident) and found that radioactive cesium-137 can cause heart disease (JIJI PRESS, 2013).

The media industry is now shifting to social media from old distribution methods such as newspapers. In the reporting of a nuclear disaster where information transmission is limited because of confusion and the danger of radiation exposure, social media has a role as a reporting tool enabling journalists to pick up some hints of the cause of the accident and distribute it as news from a unique perspective.

Conclusion

Natural disasters always happen when we least expect them. At the time of the Great East Japan Earthquake on 11 March 2011 I was in Yokohama, about 300 km away from Fukushima, reporting a political funding issue relating to the then Prime Minister. There was a sudden huge lurch and the pavements started undulating like waves. I heard mothers and children playing in the park screaming, and saw a bus jumping 1.5 metres off the ground. When I heard a loud explosion from a nearby thermal power plant, I thought I might be about to die. I can still remember how it looked and how I felt.

Soon afterwards I joined the investigative coverage team for the Fukushima nuclear disaster. I went to Fukushima several times during 2011, focusing on the health impacts of radiation exposure. I interviewed physicians and scientists in Japan and other countries and published some articles on this subject. It is worth emphasizing here that the news agency to which I belong asked me to modify my articles to avoid writing about the relationship between radiation exposure and health. Although my aim was to provide helpful information about soil contamination levels or signs of health damage to help residents decide about evacuation, I was considered to be spreading panic. However, panic arises when lack of information prevents people from thinking. Providing multi-faceted information leads to avoidance of panic, and journalists need to report without prejudice in order to communicate risk to readers.

Throughout my reporting I have to admit my own lack of preparation and experience, but I now think that a disaster such as this offers a good opportunity for journalists to develop their own journalistic skills. I have expressed these opinions in this paper.

According to the World Nuclear Association, there are currently 447 commercial nuclear power reactors operating in 31 countries including Finland, France, Russia, South Africa, South Korea, the UK, and the US. Even if there is no natural disaster to trigger a nuclear accident, as there was in Japan in 2011, a nuclear facility could be the target of a terrorist attack. In other words, a nuclear accident could happen anytime, anywhere. Therefore, journalists need to be prepared for it every day. And once an accident has happened, journalists must provide coverage assuming a worst-case scenario in order to minimize the risk of health damage for local people.

Although I am not a science journalist, I realized the seriousness of the situation from my experience of measuring contamination levels around Tokyo with a citizen's group. The effects of exposure to radiation tend to be late-onset, and writing an article about this is still professionally risky for me. However, I believe it is my duty as a journalist to keep on pointing out these risks and I hope it will contribute to developing better journalism for the younger generation of journalists.

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