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Fukushima through the prism of Chernobyl: How newspapers in Europe and Russia used past nuclear accidents

ABSTRACT: Following the news about the Fukushima nuclear accident in Japan in March, 2011, people around the globe remembered the nuclear disaster at Chernobyl in former USSR in April, 1986. This research explores influential factors of using narratives of Chernobyl in media reporting about Fukushima. An influence of the following hypothetical factors is examined: radiological consequences, geographical distance from the accident, status of a nuclear energy production, public opinion about nuclear energy and the level of a nuclear accident (INES scale). This study applies a large-scale media content analysis of newspapers articles about the Fukushima nuclear accident (N= 1340) published in the first two months of the accident in twelve press opinion leaders in Belgium, Italy, Norway, Russia, Slovenia and Spain. The results show that the memory on the Chernobyl nuclear accident appeared in more than in every third article reporting of the present Fukushima nuclear accident despite the fact that Fukushima carried no direct radiological hazard for the newspaper's audience. However, a severity of radiological, socio-political and economic consequences of the Chernobyl accident did not influence the collection of historical memory. Moreover, a closer geographical distance to the place of a collective memory – Chernobyl – did not influence the use of narratives in journalism when reporting about a similar event – Fukushima. The research showed that a frequent use of narratives is related to negative attitudes towards nuclear energy, a higher risk perception of nuclear power plants and to an active nuclear energy industry in the newspaper's country.

Key words: Nuclear accident, Fukushima, Chernobyl, mass media, journalism

1. INTRODUCTION

It is no surprise that following the news about explosions at the Fukushima Daiichi nuclear power plant in Japan in March, 2011, people around the globe remembered the nuclear disaster at Chernobyl. That accident happened in the former USSR almost 25 years prior to Fukushima in April, 1986. Although the immediate danger was the same: radioactivity, there were important dissimilarities between the two events. These can be characterised by i) the different communication and media environments in 1986 and 2011, and ii) the nature and magnitude of the accidents themselves. The similarities and dissimilarities of the two nuclear accidents open for a large degree of varying interpretations and recollections of both journalists and individuals, and these would be expected to be reflected in the media news (Behrens, Barcellos, Frewer, Nunes, & Landgraf, 2009).

The media environment in 2011 was quite unlike that in 1986. The media information about the nuclear accident in Chernobyl was delayed, censored, un-transparent, politicised, one-way and in general poor in many countries worldwide (Abbott, Wallace, & Beck, 2006; Bertell, 2008; Cantone, Sturloni, & Brunelli, 2007; Dubreuil et al., 1999; Havenaar, de Wilde, van den Bout, Drottz-Sjöberg, & van den Brink, 2003; Jackson et al., 2002; Oughton, 2008; Perko, 2011; Poumadere, 1995; Schmid, 2001; Sjöberg & Drottz, 1987). While the international public could follow the Fukushima accident in live and detailed coverage from their living rooms in 2011. In general, during the Fukushima nuclear accident *“the problem wasn’t getting expert sources; it was vetting experts sources. Everyone with broadband had access to more expertise than a media reporter could possibly read and absorb.”* underlined Sandman (2011) in his evaluation of media communication during Fukushima. In addition to traditional media channels, social media opened new potentials for multi-way communication about the nuclear accident: providing speed, multi-sources, opportunities for self-correction, a wide range of audiences, a continuous update of information, and the ability to include volunteers and citizens journalism(Perko. T, 2016).

The analysis of media comparisons between Fukushima and Chernobyl is further complicated by important similarities and differences between the accidents themselves. The Fukushima accident happened as a consequence of natural disasters combined with, a contended, design fault. The strongest earthquake ever

recorded in Japan, was followed by a tsunami that devastated a large part of the coast. The height of the tsunami breached the safety barriers and knocked out the emergency power supplies to the reactors. Despite the fact that the reactors had shut down, the lack of cooling power resulted in explosions at three of the six Fukushima Daiichi nuclear reactors, with a release of radioactivity into the atmosphere and sea over a prolonged time. Contrary to Fukushima, the Chernobyl accident was largely the result of human error, wherein the disaster happened during an experiment related to a system test. A sudden power surge appeared and due to previous overrides of safety measures, the emergency shutdown of the reactor was unsuccessful, which led to a reactor vessel rupture and a series of steam explosions. The resulting fire in the core sent a plume of radioactivity in the environment, which contaminated many European countries and an extensive geographical area in the Soviet Union (UNSCEAR, 2008). The seven-point international INES scale was established after the Chernobyl as a UN worldwide tool for communicating the safety significance of nuclear and radiological events, with the aim of facilitating understanding among technical communities, the media and the public. The Chernobyl accident was identified as a level 7 on INES scale. One month after the start of the emergency, (on 12th of April) the Japanese government upgraded the Fukushima accident on the INES scale, from a level 5 'accident with wider consequences' to a level 7 'major accident' . A level 7 represents a size 100 times greater than level 5. Subsequently, the rationale of ranking Fukushima alongside Chernobyl has been questioned (as discussed below), along with the resulting problems this caused for with public communication and understanding (IAEA, 2013: p. 31-32).

Despite the similar INES scale, the magnitude of radiological consequences due to the accidents in Fukushima and Chernobyl is different. Thirty one deaths are directly attributed to the high doses received by workers and firefighters during the Chernobyl accident. A UNSCEAR (2008) report confirmed in total 64 deaths from radiation disease, in addition to an excess of over 6000 cases of thyroid cancer in exposed children until 2005 due to radiation from the Chernobyl accident (UNSCEAR, 2013). Contrary to the Chernobyl accident, the Fukushima accident caused no immediate radiological health effects among the workers and the public. There were no radiation-related deaths and no acute radiation effects were reported (UNSCEAR, 2013). Public doses were lower at Fukushima than at Chernobyl, and although the public and children are being

monitored for possible increases in cancer, these are assumed to be below the levels at which cancer increases will be statistically significant.

The similarities and dissimilarities of the two nuclear accidents make it a valuable case study on media coverage of a nuclear accident – specifically, the way the Fukushima accident was framed through the prism of the memories of the Chernobyl accident. There is limited research on the way collective memory is used in media reporting about the same event in different countries. Our research fills this gap by an in-depth media content analysis of the way twelve prominent newspapers in six countries - Belgium, Italy, Norway, Russia, Slovenia and Spain – covered the Fukushima accident during a two month period after the emergency. None of the countries had been impacted radiologically by Fukushima and were not expected to have any consequences, but they had diverse historical memories about the Chernobyl accident, including different radiological consequences. Comparison between Fukushima and Chernobyl was amplified by the concurrence of the 25th anniversary of the Chernobyl accident within this period, which makes the collected media articles a rich source of material for studying the influence of collective memory on media reporting.

2. MASS MEDIA AND COLLECTIVE MEMORY

Several studies have researched the relationship between media and memory (Jill. A. Edy, 2006; Kitch, 2005; Lang & Lang, 1989; Schudson, 1995; Volkmer, 2006). Studies in media communication demonstrate that journalists in their news production use narratives drawn between present and past events (Barnhurst, 2003; J. A. Edy & Daradanova, 2006; Robinson, 2009; B. Zelizer, 2004). It is generally accepted that journalistic production of news is subject to the influence of collective memories, which are widely available in the public (Bommes & Wright, 1982) and help individuals to make personal connections with the past (Barbie. Zelizer, 2002). By establishing this connection, the media touch the emotions and/or the identity of its audience (Morris-Suzuki, 2005). Due to the ability of the mass media to mediate the news to a global audience and provide a common and shared experience, and thus arguably memories (Hoskins, 2010: p. 463), the media's reproduction of collective memories has *"subtle, but real effects on the ways in which we respond, or fail to respond to events, including international crises, in the present"* (Morris-Suzuki, 2005: p.27).

In this respect, there has been a broad research focusing on anniversary journalism. Anniversary journalism covers the anniversaries of important events, e.g. remembering Tiananmen and the Berlin Wall (Li & Lee, 2013) or anniversary of September 11 attacks (Britten, 2013), tenth anniversary of Earthquake in Taiwan (Su Chiaoning, 2012) or first anniversary commemoration of the 2005 London bomb attack (Lorenzo-Dus. Nuria & Bryan. Annie, 2011). The results from anniversary journalism studies among others suggest that there is a strong tendency for new themes to appear in the anniversary story and highlight the cathartic function that the event's anniversary itself seemingly fulfils. Moreover, Su Chiaoning's (2012) analysis of the Taiwan earthquake found that by portraying two interpretations of a single past event in news, media selectively employ the 'usable past,' and the implications of this for the formation of collective memories of past events. Britten (2013) demonstrated that newspapers memorialize what happened in our place above those of others, even in the absence of geographic ties to the event.

The nuclear accident in Chernobyl has not been overlooked within anniversary journalism studies. For instance, Rowe et al. (2000) indicated, among others, that geographical distance from a nuclear accident and "radiological experience" were related to the newspapers' reporting about risks around the 10th anniversary of the Chernobyl accident. Approximately four times as many reports about risks were found in Sweden as in the U.K. around the 10th anniversary of the Chernobyl accident, with Sweden being geographically closer to the accident and radiologically more affected.

In general the Chernobyl accident is well remembered in global public and media sphere. For instance Triandafyllidou (1995: p.532) analysed the framing of the Chernobyl event in the Italian press during the period from 1987 to 1991. She discovered that the "*nuclear accident of Chernobyl acquires a prominent position in the collective memory*" as the greatest tragedy and the worst accident of modern society. While producing the news, the media present it within a frame that guides the public on how this news should be understood. A classical media framing study by Gamson and Modigliani (1989) on the United States media reporting showed how years after the accident "media frames" about nuclear power incorporate Chernobyl. Moreover, in the analysis of television news about the Chernobyl accident they identified collective memories used to make narratives with the nuclear accident Three Mile Island (TMI) that has happened in

1979. *"Visually, there were many repeats of imagery from TMI coverage but with several new additions"* (Gamson & Modigliani, 1989: p. 23).

Only limited number of studies has explored the media reporting during the Fukushima accidents by looking at narratives with Chernobyl. Most of them are descriptive and based on personal observations, e.g. research by Friedman (2011). The only quantitative research, the content analysis of Katchanovski (2012), shows that both American and Canadian TV networks mostly presented the Fukushima nuclear accident as less severe than the Chernobyl nuclear accident. *"When Fukushima was rated at the maximum 7 level on the International Nuclear and Radiological Event (IAEA) scale, many news reports for the first time noted its similarity to Chernobyl"* (Katchanovski, 2012: p. 11). Katchanovski (2012) suggests that political or commercial alliances at the national level may (indirectly) influence media discourse. *"The American and Canadian coverage of the Fukushima nuclear accident, which happened in the territory of an ally of the U.S. and Canada, differed significantly in most quantitative and qualitative aspects from the coverage of the Chernobyl nuclear disaster in Ukraine, which was not an ally"* (Katchanovski, 2012:p. 17). For instance, the NBC television network in the U.S. presented the accident in Japan as less severe than Chernobyl, *"reports favourably contrasted the reactor design in Fukushima to that of Chernobyl, and they did not broadcast criticism of certain elements of the Fukushima reactor design by experts"* (Katchanovski, 2012: p. 16). The authors explained this anomaly by the effect of ownership of the NBC television network by General Electric, which designed the nuclear reactors in Fukushima.

An extensive empirical research on media reporting about Fukushima accident by making narrative about the collective memory on the Chernobyl accident in different countries is still lacking. In this research we analyse the narrative by evaluating the frequency of Chernobyl references in media coverage and whether it (this frequency) was influenced by the following factors:

- The countries' previous experience with radiological consequences of Chernobyl (assessed in terms of direct – radiological effects and socio-political effects) (H1);
- Geographical distance from Chernobyl (assessed in km) (H2);

- Status of a nuclear energy production and public opinion in the countries (assessed in terms of the number and status of operating NPPs and reactors, and related public threat perceptions) (H3);
- Changes in the INES scale of the accident (assessed from five weeks after the accident) (H4).
- Editorial policy related to nuclear energy policy (assessed by the article orientation towards nuclear energy: positive connotation - in favour of nuclear energy); negative connotation - against nuclear energy); balanced - presents arguments both in favour and against; and neutral - no discussion of nuclear energy (H5)

This article develops the notion of collective memory of nuclear accidents used in newspapers reporting by shifting the focus of previous research to the news about the Fukushima nuclear accident in six geographically distant countries, each of these countries with different collective memory on past severe nuclear accident Chernobyl.

3. METHOD

In order to test the research hypotheses, this study applies a large-scale content analysis of newspapers articles, aimed at measuring the influence of collective memory on media reporting about nuclear accident in the following six countries participating in the study: Belgium, Italy, Norway, Russia, Slovenia and Spain. Within the considered period from 11th March 2011 to 11th May 2011, a total of 1340 articles, directly or indirectly related to Fukushima, were selected for coding, in twelve press opinion leaders : “Le Soir” and “De Standaard” in Belgium (N= 260); “Corriere della Sera” and “La Repubblica” in Italy (N=270); “Aftenposten” and “Dagsavisen” in Norway (N=133); “Komsomolskaya Pravda” and “Izvestiya” in Russia (N=172); “Večer” and “Delo” in Slovenia (N=158) and “El País” and “El Mundo” in Spain (N=315).

The coding was done using standard methods for content analysis (Krippendorff, 1980, 2004; Neuendorff, 2002) and detailed in a specific code book (Perko, Turcanu, Geenen, Mamane, & Van Rooy, 2011) developed and tested for the research in Belgium. The articles have been coded by two independent coders for each

language group, thus 14 coders were involved in the study. All variation of spellings used in the examined countries have been included. In case of disagreements, a third coder, as master-coder, decided the final code based on a discussion. The inter-coder reliability was calculated by Krippendorff's alpha (reported in Table 5 in annex). All alphas are higher than 0.84 except the alpha for the variable "type of the article: letter". In this case the alpha is 0.66. In order to achieve high inter-coder reliability, each coder received training on content-analysis before she/he started the coding.

4 RESULTS

In order to explore whether references to historical nuclear accidents appear in most of the newspapers coverage of the present nuclear accident, despite the fact that the present accident carried no direct radiological hazard for the newspaper's audience and immediate country, the frequency of the word "Chernobyl" in the media texts reporting about Fukushima was counted.

Results show that the historical memory of the Chernobyl accident appeared in 37% of articles reporting about the Fukushima nuclear accident throughout the entire 2 month period. References to Chernobyl decreased from 40% of articles during the first week of the Fukushima accident to 21% of articles at week four. The highest frequency was in week seven, which coincided with the Chernobyl anniversary, when the link between the accidents, its perceptions, related feelings and fears was most prominent, and more than every second published article about Fukushima referred to the Chernobyl (**Figure 1**). Moreover, the titles of the articles in the newspapers containing the word Chernobyl appeared immediately on the first days, on the first pages of all analysed newspapers except in Slovenia; "*The ghost of Chernobyl*" (12th of March 2011, Belgium) or "*Fearing Chernobyl disaster*" (13th of March, Norway), "*Chernobyl casts its shadow over Japanese land*" (13th of March, Spain), "*Super-firemen's fight, with the Chernobyl nightmare*" (13th of March, Spain), "*Chernobyl will not happen again*" (14th of March, Russia) (For more details see Table 5 in annex). The Chernobyl nuclear accident appeared in more than in every third newspapers article reporting about of the

present Fukushima nuclear accident, despite the fact that Fukushima carried no direct radiological danger for the vast majority of the newspaper’s audience (H1).

Figure 1 here

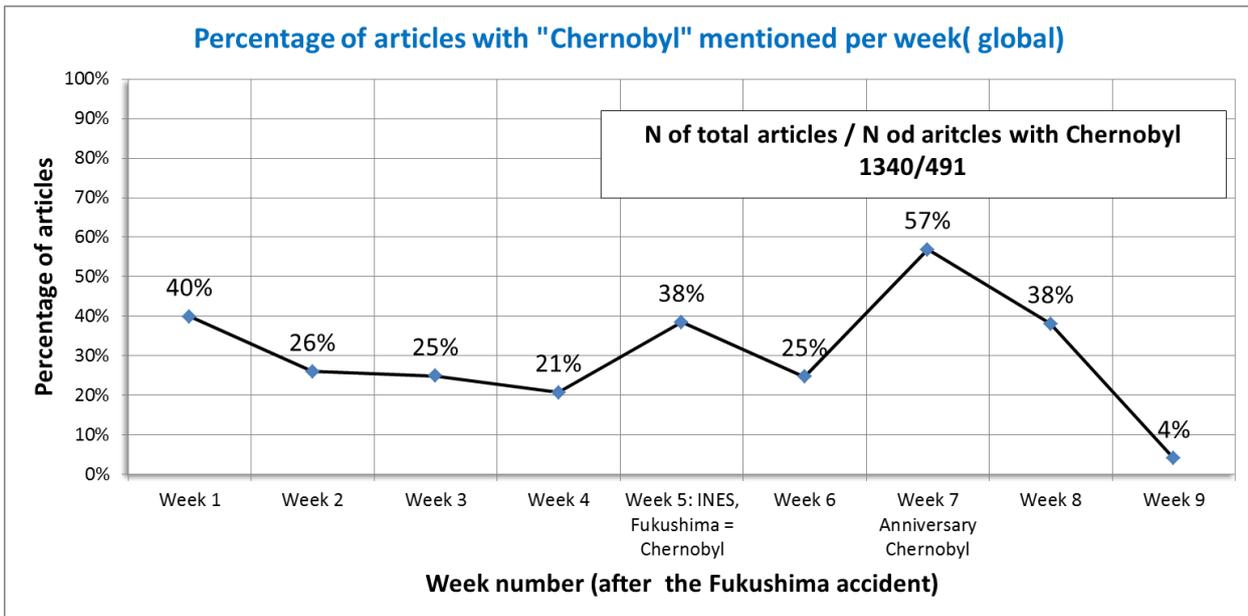


Figure 1: The word “Chernobyl” in the newspapers’ articles related to Fukushima

The number of newspapers articles linking Fukushima and Chernobyl during the anniversary week varied between the different countries, (Table 1). In Norway, all articles about the Fukushima nuclear accident in the week 7 included the world Chernobyl, more than every second article in Belgium, Russia and in Slovenia, 44% of articles in Spain and 22% of articles in Italy.

Table 1 here

Table 1: Articles about Fukushima with the word Chernobyl published in the week of nuclear emergency

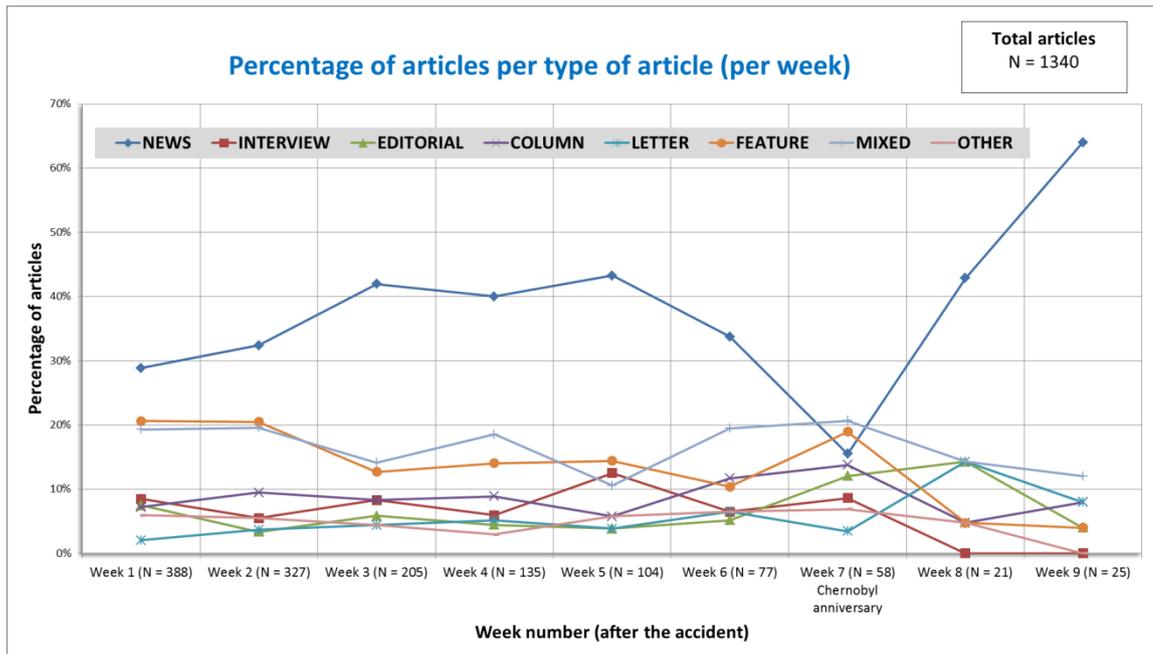
% of articles about Fukushima with the word Chernobyl published in the week of nuclear emergency										
	No of articles with word Chernobyl	Week 1	Week 2	Week 3	Week 4	Week 5- INES	Week 6	Week 7- Anniversary	Week 8	Week 9
Belgium	71	41%	24%	5%	19%	29%	25%	59%	20%	0
Italy	63	29%	20%	32%	8%	35%	8%	22%	17%	14%

Norway	41	33%	31%	6%	14%	50%	40%	100%	50%	0
Russia	56	37%	29%	29%	13%	38%	25%	86%	0	0
Slovenia	57	49%	17%	18%	26%	31%	29%	64%	0	0
Spain	132	49%	32%	47%	31%	48%	55%	44%	83%	0
SUM	491	40%	26%	25%	21%	38%	25%	57%	38%	4%

In order to further analyse the way of journalistic reporting during the 25th anniversary of Chernobyl, the type of articles reporting Fukushima was coded. The results of the media content analysis show that short news articles prevailed in the reporting about nuclear accident in general (Table 2). The exception is the week of the Chernobyl anniversary – week 7. In that week feature and mixed types of articles prevailed. Most journalists included a detailed description and analysis of the nuclear accident and its consequences including comparisons with Chernobyl. They accompanied the information with interviews or quotes from various emergency actors, local population and victims, including subjective opinions of the interviewees. The articles stressed fear, dread and uncertainty related to the Chernobyl consequences and linked them with Fukushima. For instance: “25 years ago, the apocalypse in Chernobyl” (23/4/2011, Le Soir, Belgium, p. 8) or “Never forget Chernobyl” (19/4/2011, Le Soir, Belgium, p. 1), “Chernobyl, nightmare isn't finished” (26/4/2011, La Repubblica, Italy, p. 41), “Chernobyl never again?” (26/4/2011, Dagavisen, p. 5), “The twenty-fifth anniversary of the disaster; Myths of Chernobyl” (26/4/2011, Komsomolskaya Pravda, p. 12-13), “Chernobyl in the shadow of the Fukushima catastrophe” (26/4/2011; Delo, Slovenia, p.1) or “Chernobyl does not sleep, it waits” (26/4/2011, El Pais, Spain, p. 31).

Table 2 here

Table 2: Type of articles per country per week, in percentages



The in-depth analysis of historical memory also compared the way the mass media in different countries invoked the collective memory on the Chernobyl accident. The degree to which reporting about the Fukushima accident was influenced by the countries experience of the radiological, socio-political and economic consequences of Chernobyl, as well as the nuclear energy industry and public attitudes towards the industry was assessed. The consequences of the Chernobyl accident by country are presented in Table 3.

Table 3 here

Table 3: Radiological, socio-political consequences of Chernobyl and status of nuclear industry during Fukushima in the countries

Country	Status of nuclear energy and public opinion* just before Fukushima	Radiological consequences of Chernobyl	Socio-political consequences of the Chernobyl accident	Distance from Chernobyl
Belgium	<p>-Phase-out status of nuclear energy. (2 operating NPP with 7 reactors)</p> <p>-43% of the population (Flanders) considers NPP as very dangerous. 34% considers them somewhat dangerous, 23% of the population sees NPP as not dangerous.</p>	<p>- The increase of the airborne activity in Belgium lasted two days.</p> <p>-The radioactive iodine (¹³¹I) entered the food chain, especially in milk.</p> <p>-A small amount of radionuclide Cesium (¹³⁷+¹³⁴Cs) was detected in the soil samples from different parts of the Belgian territory (from 0.9kBq/m² to 3kBq/m²).</p>	<p>-Population started to distrust in to the responsible authorities and experts for managing nuclear and radiological emergencies due to incorrect and incomplete information that was communicated during the accident (Carle, Turcanu et al. 2007).</p> <p>- Established a nuclear emergency plan, Founded the Federal Agency for Nuclear Control (FANC) and established the automatic radioactive measuring network TELERAD. (Vanmarck. H et al., 2006)</p>	Brussels: 1800 km
Italy	<p>-All NPPs were closed down after the result of the referendum on November 1987.</p> <p>-37.6% of the population is strongly opposed to the use of nuclear energy, 22.8% is fairly opposed, 22.8% is rather in favor and 10.8% is completely in favor to the use of nuclear energy.</p>	<p>The average deposition of ¹³⁷Cs ranged from 4 to 6 kBq/m² in different Italian regions. Within the European contaminated area by Chernobyl fallout in 1986, Italy is listed in the countries with a range of deposition 37–185 kBq/m² for an area of 300 km²</p> <p>-Integrated concentration of ¹³¹I in milk was estimated 11 Bq/kg (1). From 7 to 12 May the cows' milk in Rome was between 200 and 280 Bq/l</p>	<p>The post-Chernobyl Italian debate was not limited to the close examination of the technical aspects, but the debate involved values concerning social and economic development, health and environmental protection, the distribution of risks and benefits, the reliability of scientific expertise and public participation in decision making.</p> <p>Since no tradition of public dialogue and participation in Italy, the debate was polarized to “yes/no choice” and required the referendum that caused for Italy the abandon of nuclear energy.</p>	Rome: 1700 km
Norway	<p>No nuclear power plants, but two research reactors.</p> <p>-62.3% of the population consider nuclear power stations as very dangerous. 21.8% think of them as somewhat dangerous. 16% think of nuclear power stations as not dangerous.</p>	<p>One of the countries which received most fallout outside the Soviet Union (De Cort et al., 1998)</p> <p>- Fallout was heterogeneously distributed with average deposition of Cs-137 11 kBq/m³, maximum up to 200kBq/m³ (Amundsen, 1995)</p> <p>- The most affected areas were those used as pastures by domesticated animals and reindeer which resulted in elevated levels of Cs-137 in foodstuffs (Amundsen, 1995; Liland, Lochard, & Skuterud, 2009)</p>	<p>Authorities were not prepared to cope with a radiological accident; there were neither monitoring systems nor emergency plans (Amundsen, 1995)</p> <p>- Lack of clear and timely communication after the accident caused public's distrust to information coming from authorities (Hernes, 1986)</p> <p>- The countermeasures in agriculture and reindeer husbandry had to be implemented to reduce level of Cs-137 in foodstuffs and they are still necessary (Liland et al., 2009)</p> <p>- Food intervention levels for reindeer meat were raised to 6000 Bq/kg in order to aid traditional reindeer herding culture of Saami population, same was done for game meat and wild fish (Amundsen, 1995; Liland et al., 2009)</p>	Oslo: 1550 km

			- Dietary advice to public, whole body measurements and compensations to Saami population (Liland et al., 2009)	
Russia	Active nuclear 33 reactors in 10 NPP -71.9% sees NPPs as very dangerous, another 22.7% as somewhat dangerous. 5.5% sees them as not dangerous.	Chernobyl was part of the Soviet Ukraine thus Russia was the country of the accident.		Moskva: 700 km
Slovenia	Active nuclear (1 NPP with 1 reactor) - 73.8% considers NPPs as very dangerous, with 16.6% that perceives them as somewhat dangerous. 9.6% thinks of NPPs as not dangerous.	- Concentration of ¹³¹ I in milk of 24 - 11 - 3.6 Bq/kg in 3 different regions Within reference (2) IAEA 2006, Slovenia is considered among the countries with a contamination of ¹³⁷ Cs more than 37 kBq/m ² with an area of 300 km ² with a contamination in the range 37- 185 kBq/m ² . A radioactivity in the ground was strongly depending on the rain from the radioactive cloud. This rain was asymmetrically spread in the country. The following protection measures were carried out based on the measurements of contamination: - interdiction/prohibition of grazing of cows on pastures. This way, the authorities efficiently prevented contamination of milk, especially with iodine 131. - interdiction of use of the rain water in the preparation of food for human consumption and for cattle watering - interdiction of consumption of fresh vegetables - Interdiction of hunting of some animal species	Public has become concerned about the nuclear safety. Public debate about the national nuclear energy was conducted more or less in the context of the socialist political regime which did not allow for much criticism. Public opinion poll has shown that a large majority of population is afraid (46,4%) or very afraid (42,5%) that such a disaster can happen in Slovenia or near Slovenia. Additionally, public opinion in terms of support for building a second nuclear power plant in Slovenia has shifted after Chernobyl. In 1982, only around 25% of population were against this option, while in 1987 already around 80% of population were against this option. Protection plans in case of nuclear disaster were reviewed despite the fact that the plans were relatively new.	Ljubljana: 1300 km
Spain	-Operating 8 reactors at 6 sites. -Debate on life-extension and interim storage of spent fuel and high-level radioactive wastes. - 69.9% of the Spanish population thinks NPPs are very dangerous, 19% perceives NPPs as somewhat dangerous, 11.1% sees NPPs as not dangerous.	Negligible. Only small amounts of radioactivity (mainly ¹³¹ I) were detected in migratory birds in spring 1986.	Not significant from the social or political points of view. When the Chernobyl accident happened, the regulatory body (CSN) had already been created and was consolidating as independent, only reporting to the Parliament. The main impact was on improving emergency preparedness for nuclear accidents: - New technical centre for nuclear emergencies (24/24 hours). - New automated radioactivity surveillance networks and independent laboratories at universities.	Madrid: 2900 km

			<ul style="list-style-type: none"> - Improved coordination between civil protection authorities at central and local level. - Research focus on severe accidents and emergency support systems (in coordination with U.S. NRC and European Commission). - Consolidation of “safety culture” programmes at the NPPs. 	
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**In Belgium, Norway, Russia, Slovenia and Spain data refers to surveys conducted in 2010; The statement wording in the survey was: “Nuclear power stations are...” i)Extremely dangerous for the environment, ii) Very dangerous, iii) somewhat dangerous, iv) Not very dangerous, v) Not dangerous at all for the environment, (ISSP, 2010); In Italy the survey was conducted in 2010;, with the question wording: “To what extent are you in favour or opposed to the use of the nuclear energy:”, i) Totally in favour, ii) Fairly in favour, iii) Fairly opposed, iv) Totally opposed (European Commission, 2013).*

Figure 2 here

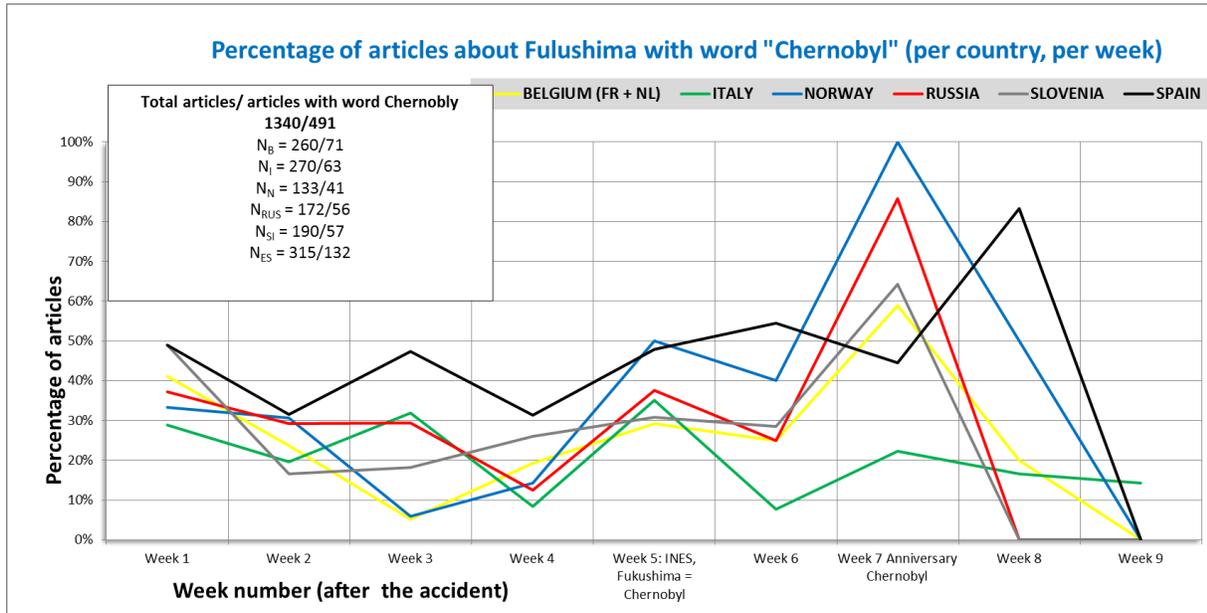


Figure 2: Word Chernobyl in the articles per country

The results show, that the newspapers from Spain referred to the Chernobyl accident more often than any other newspapers from the analysed countries (Figure 2). 42% of Spanish articles reporting about the Fukushima accident made a link to Chernobyl. In the first week of the Fukushima accident, every second article contained the word Chernobyl which was included even in titles of 18 articles, for instance: *“Japan fights against the clock to prevent its Chernobyl”* (El Mundo, 2011-03-14, p.1 and p.20), *“We did not learn from Chernobyl mistakes”* (El Mundo, 2013-03-17, p.25), *“Japan fights to prevent another Chernobyl”* (El País, 2011-03-16, p.2 and p.3). The frequent use of the Chernobyl in Spanish media reporting about Fukushima is interesting, since Spain was the less radiological affected country due to the Chernobyl accident among the analysed countries (Table 3). Opposite to the Spanish newspapers, the Belgian newspapers involved Chernobyl in 27% of the articles related to the Fukushima. In general, the public opinion about the NPP’s was more favorable in Belgium than in Spain in the year before Fukushima, with

43% of population perceiving NPP's as very dangerous for the environment in Belgium and 70% in Spain. The lowest frequency in using Chernobyl for reporting about Fukushima appeared to be in Italy; 23% of articles about Fukushima using word Chernobyl. The public opinion related to use of nuclear energy was in Italy in the year before Fukushima the most favorable among analyzed countries; more than one third of the Italian population being in favor or strongly in favor of nuclear energy (Table 3).

From Figure 2 and Table 3 it appears that newspapers in countries with an active nuclear energy industry (Spain and Russia) tended to refer more often to the Chernobyl accident in media reporting about Fukushima than newspapers from countries without a nuclear energy industry (Italy, Norway), or undergoing a phase-out nuclear energy program (Belgium) (H3).

It also seems that journalists from countries where the public has more negative attitudes towards nuclear energy or higher risk perception of the nuclear power plants (Slovenia, Russia and Spain) were more likely to use the Chernobyl accident as a reference in the Fukushima reporting, than countries with lower risk perception of nuclear power plants (Italy and Belgium) (H3).

Surprisingly, a past experience with enhanced radiological risks and socio-political and economic consequences due to the Chernobyl accident did not appear to influence the use of the historical memory in a media reporting about Fukushima.

For example, Spain was the country with the least direct experiences of radiological consequences due to Chernobyl, yet published "Chernobyl" the most frequently in newspaper articles about Fukushima among all analysed countries. On the other hand, Russia which as a country had significant radiological

consequences due to the Chernobyl accident (Chernobyl was at the time of the accident part of the same country) also frequently referred to the past nuclear accident.

In addition, a direct comparison of the radiological risks resulted from the Fukushima nuclear accident with radiological risks from other historic nuclear accidents was analysed for instance Windscale (United Kingdom, 1957), Three Mile Island (Harrisburg, Pennsylvania, USA, 1979), Chernobyl (Soviet Ukraine, 1986), and Tokai Mura (Japan, 2000). In this analysis only the articles with the comparison of radioactivity and not an accident in general are included. (e.g. nuclear bomb on Hiroshima or Nagasaki, number of victims or size of evacuation are not included).

The analysis in Table 4 shows that the radiological comparisons of the nuclear risk were not of a paramount importance for journalists reporting about Fukushima since only maximum 15 % of the articles per country contained the radiological risk comparison. The comparison of radiological risks from Fukushima with radiological risks from Chernobyl was in the analysed articles used the most frequently among all the accidents.

Secondly, newspapers in Italy as the country with strong socio-political consequences due to the Chernobyl accident (referendum results barred the nuclear energy program after the Chernobyl) the Italian media used the reference to the Chernobyl as the lowest frequency (23% of articles). Contrary, the newspapers from Spain (no significant socio-political or economic consequences) have used the reference to the Chernobyl accident the most frequently among the analysed countries.

In other words, the collective memory on the Chernobyl accident could be recalled in a mass media reporting about the Fukushima accident to the same extent in countries with severe radiological, socio-

political and economic consequences as in the countries with no or limited consequences due to the Chernobyl.

Table 4 here

Table 4: Comparison with historical accidents in a media reporting about Fukushima

Comparison of Fukushima with historical nuclear accident	No. of articles with an accident comparison / all articles in the country	%	% out of all risk comparisons*	% out of 130 comparisons with an accident in all countries
Belgium	23/260	9	38%	18%
Italy	41/270	15	58%	32%
Norway	7/133	5	39%	5%
Russia	7/190	4	13%	5%
Slovenia	5/190	3	18%	4%
Spain	47/315	15	42%	36%

*Other comparisons then with historical accident are: with risks from medical purposes, with risk from flying, with natural radiation background, with worker’s exposure, with legal limits/norms and with something else.

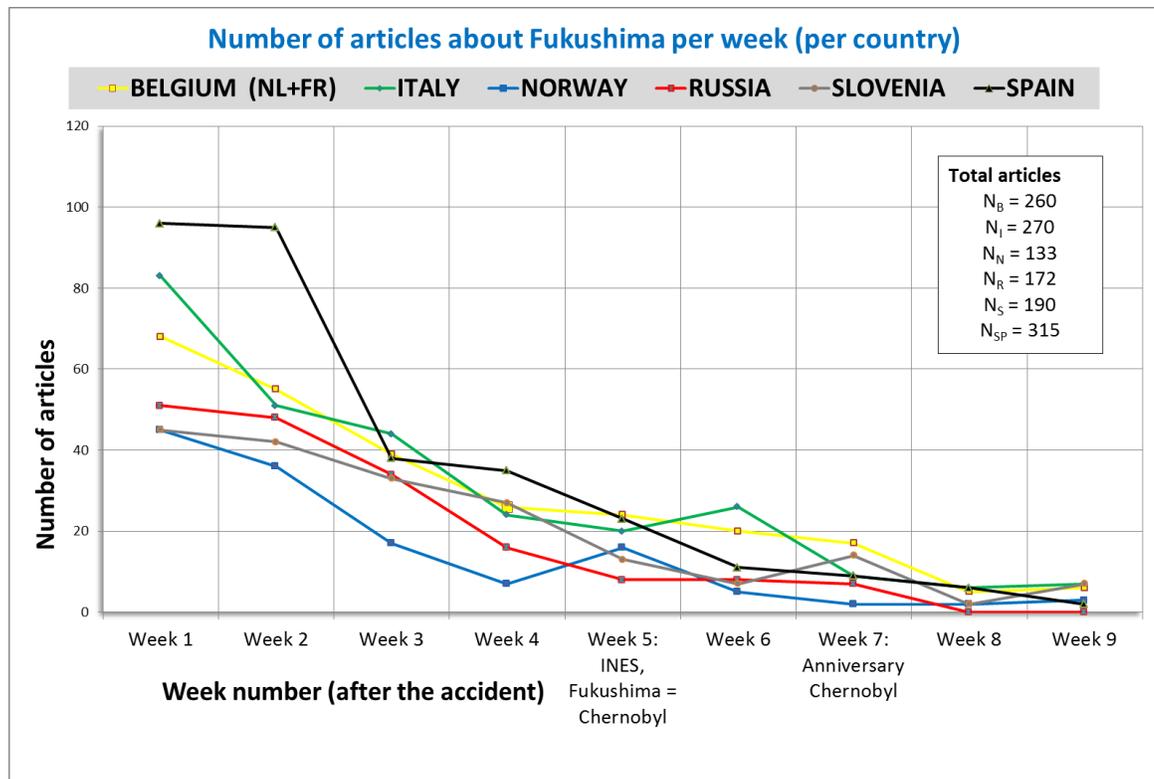
In addition to a lack of influence of radiological risk experience, the influence of the geographical distance from the historical accident and larger socio-political and economic consequences was also not related to the frequency of use of the historical memory in reporting about the similar accident. We can conclude that a smaller geographical distance from the place of a collective memory – Chernobyl –, don’t influence the use of narratives in journalism when reporting about a similar event (H2).

To test the importance of the INES scale for using a narrative of a historical nuclear accident in reporting about the present accident (H4), the media interest in the INES scale - the tool for communicating the safety and radiological significance of the nuclear event - is analyzed. The INES scale aims to facilitate communication and understanding of nuclear events among technical communities, the media and the public. The Japanese government and international community upgraded the Fukushima accident on the INES scale from level 5 ‘accident with wider consequences’ to level 7 ‘major accident’ - the same level as the Chernobyl accident - only one month after the beginning of the nuclear emergency (Week 5: 12th of

April). Figure 3 shows that the Fukushima nuclear accident was followed closely by the media. It attracted a lot of media attention in the first weeks; followed by a steady, but decreasing coverage in the following weeks including in the week 5, when the escalation of the accident level reached the highest level possible (INES level 7) and the number of articles about Fukushima decreased. However, the articles published in the week 5 included the comparisons of the Fukushima accident with the Chernobyl accident more often than before. 38% of the articles related to Fukushima contained the word Chernobyl in the week of upgrading the INES scale to the highest level (Figure 1). For instance, every second article about Fukushima published in the analysed newspapers in Norway and Spain referred to the Chernobyl. The upgrading of the severity level of Fukushima was published in all newspapers in all analyzed countries. The comparison of Fukushima with Chernobyl after reaching the same level of significance became salient also in the titles of the published articles, for instance *“Accident on the same level with Chernobyl”* (Aftenposten, 2011-04-12, p.5), *“Fukushima is already the Chernobyl of XXI century”* (El Mundo, 2011-04-13, p.3), *“Fukushima like Chernobyl, severity level 7”* (Corriere della Sera, 2011-04-13, p.14), *“Fukushima was given Chernobyl's level of risk”* (Komsomolskaya Pravda, 2011-04-13, p.7), *“Fukushima now on the level of Chernobyl”* (Delo, 2011-04-13, p.28) or the media in Belgium questioned *“Is Fukushima as bad as Chernobyl?”* (De Standaard, 2011-04-13, p.12) (See annex). Since there was a decreasing media attention to the Fukushima accident in general and increasing use of the Chernobyl in the week 5 we can only conclude a minor influence.

Figure 3 here

Figure 3: Number of articles about Fukushima per week



About 20% of articles related to the Fukushima nuclear accident also discussed political aspects of nuclear energy policy (N=420). 4% of the articles with the word Chernobyl had a positive orientation towards nuclear energy, 12% were negative and 8% showed a balanced orientation towards nuclear energy (presented both pro and contra arguments about nuclear energy). In general, nuclear energy was most frequently discussed in the articles published in Italy, where the majority of the articles had a negative orientation towards nuclear energy. Significant differences in the orientation of articles towards nuclear energy were observed between the countries. From mostly negative reporting in Italy to mostly positive reporting in Russia. Reporting in the Italian newspaper could be explained by the fact that there was in the time of Fukushima a vivid debate about nuclear energy policy related to the planned referendum about the renewal of nuclear energy program, which had been under a moratorium following the Chernobyl accident. In week 7 and 8 all articles discussing nuclear energy in Italy were negative. This could be linked to the anniversary of Chernobyl. In Belgium and Norway however, the article orientation was been more equally distributed, except in week 7 where there is a more negative orientation towards

nuclear energy. Again, this could be linked to the Chernobyl anniversary. Russia and Slovenia showed a slightly different picture. A low presence of negative articles in general and, in the first two weeks in Russia, most articles discussing nuclear energy were positive. In general, the articles with the expressed negative attitudes towards nuclear energy had higher frequency of the word Chernobyl than the rest. Thus, the hypothesis (H5) can be supported.

5. DISCUSSION

Our study seeks to expand the research related to use of historical memory in journalistic reporting about nuclear accidents with the help of media content analysis and expose the less obvious, implicit appearance of memories on the Chernobyl accident in the media coverage of present nuclear accident – Fukushima.

The results show that the memory on the Chernobyl nuclear accident appeared in more than in every third article reporting of the present Fukushima nuclear accident in Belgium, Italy, Norway, Russia, Spain and Slovenia, despite the fact that Fukushima carried no direct radiological hazard for the newspaper's audience.

While Rowe et al. (2000) found the importance of the geographical distance from an accident and radiological experience as a significant indicators for anniversary journalism our results show that severe radiological, socio-political and economic consequences of the Chernobyl accident did not influence the collection of historical memory. Moreover, a closer geographical distance to the place of a collective memory – Chernobyl – did not influence the use of narratives in journalism when reporting about a similar event – Fukushima. On the other hand, the research showed that journalists from countries where the public has more negative attitudes towards nuclear energy or a higher risk perception of nuclear

power plants (Slovenia, Russia and Spain) tended to use the Chernobyl accident more often as a reference within Fukushima reporting than countries with lower risk perception of nuclear power plants (Italy and Belgium). Moreover, newspapers in countries with an active nuclear energy industry with many reactors (Spain and Russia) referred more often to Chernobyl in media reporting about Fukushima than newspapers from countries without nuclear energy industry (Italy, Norway). Similarly, the newspapers from country with phase-out nuclear energy program (Belgium) referred to the Chernobyl accident less often than the newspapers published in the active nuclear energy industry countries. The comparison of Fukushima with Chernobyl after reaching the same level of significance (INES 7) became salient all newspapers in all analyzed countries. Since there was a decreasing media attention to the Fukushima accident in general and increasing use of the Chernobyl in the week 5 we can only conclude a minor influence of the INES scale rating on the media reporting. Interestingly, a study on the way national context moderated a change in support for nuclear energy after the Fukushima accident by Latré et al. (2017) showed an influence of the accident on public opinion. This study reported a survey conducted shortly after the accident with more than 23,000 respondents from 41 countries, and indicated an influence of geographical distance from the accident on opinions : the decrease in support for nuclear energy was stronger in countries closer to Fukushima and support for nuclear energy decreased more in countries where new nuclear reactors were under construction. However, the country's nuclear energy production status and press freedom did not influence a opinion change in 41 countries after the Fukushima accident) (Latré et al., 2017).

While it is perhaps not surprising that memories of Chernobyl were in mass media invoked by the Fukushima accident, the comparisons varied in frequency but also the way they compared Chernobyl and Fukushima. These cover concerns during the emergency period that the accident might eventually prove to be as serious as Chernobyl, as well as comparisons that range from presenting Fukushima as being as

serious as Chernobyl to articles reporting that Fukushima did not have the same level or extent of health or environmental consequences as Chernobyl. Given the possibility of some risk comparisons leading to public misunderstanding – for example that Fukushima also caused radiation deaths due to high exposures in workers – it would be important to follow the studies with further analysis now that there is more information about the situation at Fukushima. The forthcoming 30yr anniversary of Chernobyl and 5 year anniversary of Fukushima would be an obvious opportunity.

“Real world events” (Iyengar, 1991) or *“focusing events”* (Birkland, 1997) like nuclear accidents in Fukushima and Chernobyl directly affect the media agenda and have an indirect effect of on the public's concerns through a media coverage. Two widely used theories describe the relationship between major events and changes in policy. The first theory, the Punctuated Equilibrium Theory (Jones & Baumgartner, 2005) showed that such events have the capacity to punctuate the longstanding equilibrium that characterizes policy. The second theory, the Advocacy Coalition Framework (Sabatier and Jenkins-Smith (1999) stresses the role of external events on policy agenda as the events serve as shocks that can result in policy change. The study of the way in which media, public and official agendas impact each other and interact is beyond of this paper and is suggested as future research.

6. CONCLUSIONS

Severe nuclear accidents are mainly indirectly experienced around the globe by following mass media reporting. Studies in media communication demonstrate that journalists in their news production use narratives drawn between present and past events which are widely available in the public sphere. This research explores influential factors of using narratives in reporting about a nuclear accident and compares the effect of these factors in six countries with different radiological hazards: Belgium, Italy, Norway, Russia, Slovenia and Spain. An influence of the following hypothetical factors on using narratives in a media reporting about an accident are examined: radiological consequences, geographical distance

from the accident, status of a nuclear energy production, public opinion about nuclear energy and the level of a nuclear accident (INES scale). The results show that the memory on the Chernobyl nuclear accident appeared in more than in every third article reporting of the present Fukushima nuclear accident despite the fact that Fukushima carried no direct radiological hazard for the newspaper's audience. However, a severity of radiological, socio-political and economic consequences of the Chernobyl accident did not influence the collection of historical memory. Moreover, a closer geographical distance to the place of a collective memory – Chernobyl – did not influence the use of narratives in journalism when reporting about a similar event – Fukushima. The research showed that journalists from countries where the public has more negative attitudes towards nuclear energy or a higher risk perception of nuclear power plants tended to use the Chernobyl accident more often as a reference within Fukushima reporting than countries with lower risk perception of nuclear power plants. Newspapers in countries with an active nuclear energy industry with many reactors referred more often to Chernobyl in media reporting about Fukushima than newspapers from countries without nuclear energy industry. These results indicate that journalistic reporting about severe nuclear accidents has its dissimilarities in comparing to other accidents and that radiological consequences of the accident are not as important as are risk perception and attitude towards nuclear energy for using a narrative in a media reporting. The results related to the influence of the historical memory in media reporting are of great importance for explanation of media role in nuclear or radiological emergencies and public understanding of nuclear accidents.

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Annex:

Table 5: Inter-coder reliability: Krippendorff's alpha and number of disagreements for variables per language category

		Norway		Italy		Belgium - Dutch		Belgium - French		Slovenia		Russia		Spain	
		Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha
KEYWORD	Chernobyl	0	1	1	0.99	0	1	0	1	0	1	0	1	2	0.99
COMPRISK	no comparisons	0	1	1	0.99	9	0.84	0	1	0	1	0	1	8	0.97
	with risks from medical purposes (e.g. x-ray)	0	1	0	1	0	Not Sel	0	Not Sel	0	Not Sel	0	1	0	1
	with risks from flying	0	Not Sel	0	Not Sel	0	Not Sel	0	Not Sel	0	Not Sel	0	1	0	1
	with natural radiation background	0	1	4	0.9	1	0.95	2	0.82	0	1	1	0.95	0	1
	with workers' exposure to radiation at nuclear inst.	0	Not Sel	0	Not Sel	0	1	1	0.81	0	1	0	Not Sel	0	1
	with something else	0	Not Sel	0	1	0	1	0	1	0	1	2	0.93	0	Not Sel
	with (legal,...) limits, norms	0	1	2	0.95	1	0.97	0	1	0	1	0	1	2	0.99
	with a historic nuclear accident	0	1	1	0.99	0	1	1	0.81	1	0.91	1	0.93	4	0.97
TYPE OF ARTICLE	NEWS	0	1	3	0.96	4	0.94	4	0.92	9	0.9	6	0.9	0	1
	INTERVIEW	0	1	1	0.98	0	1	0	1	0	1	3	0.94	0	1
	EDITORIAL	0	1	0	1	1	0.8	0	1	0	1	0	Not Sel	0	1
	COLUMN	0	1	1	0.98	0	1	0	1	0	1	0	1	0	1
	LETTER	0	Not Sel	0	1	0	1	0	1	1	0.66	0	Not Sel	0	1
	FEATURE	0	1	9	0.91	3	0.9	1	0.96	9	0.86	5	0.9	0	1
	MIXED	0	1	12	0.87	5	0.72	5	0.7	0	Not Sel	11	0.84	0	1
	OTHER	0	1	2	0.92	1	0.95	0	1	1	0.89	1	0.95	0	1

		Norway		Italy		Belgium - Dutch		Belgium - French		Slovenia		Russia		Spain	
		Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha	Dissagre.	Alpha
Article orientation towards nuclear	Positive	0	1	3	0.9	2	0.79	0	1	0	1	0	1	0	1
	Negative	1	0.94	1	0.99	1	0.95	1	0.95	3	0.39	0	1	0	1
	Balanced (both views)	1	0.94	2	0.92	0	1	1	0.94	9	0.55	1	0.85	0	1
	Neutral (doesn't concern this)	0	1	3	0.97	5	0.86	2	0.95	11	0.59	1	0.97	0	1

Table 6: Chernobyl in the titles of the articles related to Fuk

Entirely (1) and partly (2) about Fukushima	Titles of the Fukushima articles containing the word Chernobyl (Translated to EN)	Date of publication	Newspaper	Page no.
Belgium: N=10				
1	The ghost of Chernobyl	2011-03-12	De Standaard	3
1	The crime of Chernobyl	2011-03-18	De Standaard	60
1	Chernobyl, the nightmare of Japan	2011-04-02	De Standaard	56
1	Fukushima is no Chernobyl yet	2011-04-08	De Standaard	18
1	Is Fukushima as bad as Chernobyl?	2011-04-13	De Standaard	12
1	Fukushima a new Chernobyl "very unlikely"	2011-03-15	Le Soir	4
2	Chernobyl, 25 years of fog	2011-04-18	Le Soir	8
2	Never forget Chernobyl	2011-04-19	Le Soir	1
1	25 years ago, the apocalypse in Chernobyl	2011-04-23	Le Soir	1
1	Chernobyl - Science wants the real results	2011-04-28	Le Soir	8
Italy: N=11				
1	Super-firemen's fight, with the Chernobyl nightmare	2011-03-13	Corriere della Sera	3
1	Fukushima, alert level rises, Chernobyl-solution for the reactors	2011-03-19	Corriere della Sera	18-19
1	Fukushima like Chernobyl, severity level 7	2011-04-13	Corriere della Sera	14
1	Japan admits «We are like Chernobyl»	2011-04-13	Corriere della Sera	1
1	Chernobyl nightmare in the safety empire	2011-03-12	La Repubblica	4
1	A new Chernobyl, the atomic threat scares the planet	2011-03-15	La Repubblica	6
1	Fukushima can become like Chernobyl	2011-03-26	La Repubblica	25
1	Chernobyl's risk is closer, without intervention the reactor can explode	2011-03-28	La Repubblica	17
1	Chernobyl, nightmare isn't finished	2011-04-26	La Repubblica	41
1	Super-firemen's fight, with the Chernobyl nightmare	2011-03-13	Corriere della Sera	3
1	Fukushima, alert level rises, Chernobyl-solution for the reactors	2011-03-19	Corriere della Sera	18-19
Norway: N=6				
1	Fearing Chernobyl disaster	2011-03-13	Aftenposten	10-11
1	Chernobyl is still an example of horror	2011-03-18	Aftenposten	16
1	Accident on the same level with Chernobyl	2011-04-12	Aftenposten	5
1	The nuclear accident on the same level with Chernobyl	2011-04-13	Dagsavisen	18
1	Chernobyl never again?	2011-04-26	Dagsavisen	5
1	Chernobyl heritage	2011-04-26	Dagsavisen	2
Russia: N=11				
1	Chernobyl will not happen again	2011-03-14	Izvestiya	1.4

Entirely (1) and partly (2) about Fukushima	Titles of the Fukushima articles containing the word Chernobyl (Translated to EN)	Date of publication	Newspaper	Page no.
1	10 naive questions about the "Fukushima's" Chernobyl	2011-03-16	Komsomolskaya pravda	5
1	Chernobyl disaster fighter "You can turn off the kettle, but the boiled water wouldn't cool down immediately"	2011-03-16	Komsomolskaya pravda	5
1	"Fukushima" is more terrifying, than Chernobyl	2011-03-19	Komsomolskaya pravda	4
1	They won't manage without our volunteer Chernobyl disaster fighters	2011-03-19	Komsomolskaya pravda	5
1	Experts reassure: there won't be a Japanese Chernobyl	2011-03-24	Komsomolskaya pravda	2
1	"Fukushima" is catching up Chernobyl	2011-03-28	Komsomolskaya pravda	3
2	Wedding in Chernobyl style	2011-03-29	Komsomolskaya pravda	25
2	Chernobyl is not an atomic bomb	2011-03-31	Izvestiya	2
1	"Fukushima" was given Chernobyl's level of risk	2011-04-13	Komsomolskaya pravda	7
2	The twenty-fifth anniversary of the disaster. myths of Chernobyl	2011-04-26	Komsomolskaya pravda	12.13
Slovenia: N=6				
2	One quarter of a century of suffering after Chernobyl	2011-03-29	Delo	28
1	Fukushima now on the level of Chernobyl	2011-04-13	Delo	28
1	Hiroshima, Chernobyl, Fukushima	2011-04-26	Delo	7
2	Chernobyl in the shadow of the Fukushima catastrophe	2011-04-26	Delo	1
1	There were no iodine pills in Chernobyl, Japan is distributing them	2011-03-16	Vecer	3
1	Ban Ki Moon visits Chernobyl	2011-04-21	Vecer	6
Spain: N=18				
2	Chernobyl casts its shadow over Japanese land	2011-03-13	El Mundo	33
1	Japan fights against the clock to prevent its Chernobyl	2011-03-14	El Mundo	1, 20
1	A wall separates Japan from Chernobyl	2011-03-14	El Mundo	22
1	"It is a Chernobyl in slow motion"	2011-03-16	El Mundo	28
1	"We did not learn from Chernobyl mistakes"	2013-03-17	El Mundo	25
1	Chernobyl and the art of burying nuclear "trash"	2011-03-20	El Mundo	39
1	Fukushima is already the Chernobyl of XXI century	2011-04-13	El Mundo	3
1	Fukushima reaches Chernobyl	2011-04-13	El Mundo	22, 23
2	From Chernobyl to Fukushima, nuclear comics	2011-04-18	El Mundo	35
1	Japan fights to prevent another Chernobyl	2011-03-16	El País	2, 3
1	The "Chernobyl solution", last choice	2011-03-19	El País	18

Entirely (1) and partly (2) about Fukushima	Titles of the Fukushima articles containing the word Chernobyl (Translated to EN)	Date of publicaiton	Newspaper	Page no.
2	Ukraine's nuclear option continues in spite of Chernobyl and Fukushima	2011-03-21	El País	16.17
1	Fukushima is not Chernobyl	2011-03-21	El País	36
1	A Chernobyl in slow motion	2011-04-13	El País	8
1	Fukushima is not Chernobyl	2011-04-20	El País	24
1	The OECD seeks to change the nuclear scale to differentiate Fukushima and Chernobyl	2011-04-25	El País	12
2	Chernobyl does not sleep, it waits	2011-04-26	El País	31
1	Return to Chernobyl	2011-05-01	El País	34