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Mapping and characterising changes to risk amplification within the British Press: 1985-2017

Abstract

British news media were central to the amplification of health risk concerns in the late 1990s and early 2000s such as mobile phone radiation, genetically modified foods and the MMR vaccine, which made an international impact. Few comparable examples seemed to follow, suggesting this was a distinctive period of risk amplification. This impression was investigated both qualitatively and quantitatively. Content analyses were conducted on a corpus of British risk reporting (n=63,423) from across the range of daily national newspapers. Quantitative content analysis investigated changes to the volume of risk-based news publication, alongside the expression of sensationalist and politicising language. The qualitative content analysis utilised a rhetorical framing analysis to explore the changes to risk amplifying news frames across a sample of highly amplified news stories (n= 1490). The framing analysis sought to investigate temporal changes to the expression of uncertainty, certainty, blame, trust, stigma and dread within risk reporting. We found evidence that there was an early peak period and subsequent waning of amplification. Further, we identified four distinct periods of risk reporting which are elaborated in the paper: a period of low risk amplification between 1985-1994; a second period of high-risk amplification between 1995-2004; a third period of low but distinct amplification between 2005-2014; and an ongoing contemporary and more speculatively defined period from 2015 of higher amplification.

Wordcount: 7389

Keywords: Risk, Amplification, Corpus-based research, Newspapers, Science, Health

Introduction

This article highlights corpus-related results from a mixed method study of changes over time in the news media reporting of risk-related issues in the United Kingdom. The project was born of longstanding interest in the changing British risk landscape which shifted from a self-identity around ‘keep calm and carry on’ resilience, towards greater focus upon, and intolerance of, risk (author ref). This process mirrors the theoretical transition towards a ‘risk society’ from the 1960s, indicated by Beck (1996). But analysed empirically, we can identify the impact of particular issues, crises and how they were managed, and understand an active rather than only theoretical process.

This study was informed by the social amplification of risk framework (SARF) whose ‘main thesis is that hazards interact with psychological, social, institutional, and cultural processes in ways that may amplify or attenuate public responses to the risk or risk event’ (Kasperson et al 1988). Risk information enters wider public consciousness through a communications pathway which attributes socio-political significance to the technical knowledge of risk. Although not clearly defined within SARF originally, amplification refers to the discrepancy between expert and lay points of view and between expert assessments of the risk and the magnitude of the impacts that do or do not follow (Breakwell and Barnett 2001, 7). A result of socially amplified risk is that the future occurrence of low probability risks becomes unanchored from technical understanding of probability and embedded within the relative knowledge of public discourse. News media are widely considered to be a key social station of risk amplification, given their role in repackaging risk information for mass dissemination.

SARF is a limited tool, justifiably criticised for its mechanical and sequential analysis, ‘with the attendant assumption that influences “on the way” will be distortions of the original signal’ (Rip 1988, 197). But its focus upon understanding how social processes could mediate between a hazard event and its consequences remains useful. Further, issues with defining the amplification of single events can be limited through comparative analysis focused upon differing responses to comparable events (Burgess 2012). This study comparatively and quantitatively analyses over a long time frame, and compliments this perspective with qualitative study of the changing language used to frame events. At the same time, we see amplification and attenuation in more sociological and subjective terms, as ‘something that social actors attribute to one another as they try to explain their systematic differences in response, not an objective characterisation of a response that is somehow disproportionate to its stimulus’ (Busby and Duckett 2012, 1049). We are interested in the changing expression of risk events over time (and what may inform these changes) and in the process, hope to have added to the practical development of SARF-influenced media analysis.

Adekola (2020) has identified two mechanisms within SARF research by which mediated risk information can be amplified. Amplification under the Information Mechanism of SARF may be achieved when there is an uncharacteristically high volume of risk information, sensationalism of risk information, and politicisation of risk information compared to other news cycles. Risk amplification under the Response Mechanism of SARF may be achieved through uncharacteristically high exhibition of dread, uncertainty, trust, blame, and stigma within news texts. To date, however, there has been little empirical work which has sought to substantiate how the units of social risk amplification operate in concert with one another to amplify risk information within news texts.

The greater UK risk profile and transition is exemplified by changing responses to BSE/vCJD or 'mad cow disease', which appeared as a human condition from 1996. An apparent sustained denial of risk (rejecting the likelihood of the disease moving from cattle) subsequently gave way to unprecedented levels of regulation and transparency through the new Food Standards Agency. More broadly, a shift in risk discourse and politics became evident that tended to reject the denial or downplaying of risk and instead seriously regard claims of possible, even hypothetical harm (Booker and North 2007; author ref).

This project was driven particularly by curiosity about the apparent intensity of risk amplification during the late 1990s - following the BSE experience - that subsequently appeared to attenuate. The UK became a focus of international attention for risk amplification of issues such as mobile phone related health concerns and genetically modified 'Frankenfoods' (GMOs), as they were popularly described from the late 1990s - led by UK campaigns and media (Hellsten, 2003). Such claims of harm made an international impact and were important to the evolution of precautionary regulatory politics during this period (author ref). Stigmatization was crucial to the de facto banning of GMOs from Europe. Another significant example was the international vaccination crisis around the MMR jab initiated by the 1998 UK publication of the fraudulent paper associating it with autism, with the link then promoted by numerous newspapers (Petts and Niemeyer 2004).

This study is focused upon newspapers in particular, because of their degree of impact and influence as amplification stations. Newspapers have historically played an unusually significant role in British life, that is arguably unprecedented internationally (Temple 2008; Williams 2009). *The Times*, for example, is historically known as the 'voice' of the British establishment. Others such as the *Sun*, *Daily Mail* and *Guardian* define and articulate the interests and outlooks of different classes and constituencies and can exert considerable influence upon policy. For example, UK governments will not openly consider legalising drugs for fear of the damaging outcry they foresee would be driven by the *Daily Mail*, in particular (Williams 2009). On the other hand, newspapers have given voice to radical concerns and challenged established authority around public scandals such as thalidomide, as the *Sunday Times* did in the 1970s (Temple 2008). During the period of particular interest here - of the late 1990s - this campaigning mode became more prominent and focused upon issues of possible dangers such as from new technologies. Mobile phones were identified as 'the next smoking' by newspapers and subsequently associated with a range of possible effects to affirm problematic connections, generating amplification (author ref).

As well as their interesting and significant role, newspapers were also focused upon in this study for methodological reasons, given the opportunity they provide for rigorous and extensive analysis. In addition, during the 1990s/2000s other sources such as social media remained undeveloped and less influential than today.

The starting point for this study was our perception of a process of de-amplification following the apparent risk amplification and campaigning period of the late 1990s/early 2000s. Not only did health risks appear to become less of a media staple into the later 2000s, but a counter trend emerged of challenging such claims. For example, the *Guardian* newspaper was at the forefront of anti-GMO campaigning but reoriented itself towards a pro-science stance, publishing the 'Bad Science' column from the mid-2000s onwards, which challenged baseless claims of harm to

health (Goldacre 2019). Additionally, controversies around health risks at this time appeared to be comparatively muted in terms of scale and impact.

Further, there were plausible reasons to explain why a de-amplifying shift may have taken place. The MMR scare and the media's prominent role in its spread, in particular, was seen as hugely damaging and prompted a reaction against uncritical reporting of risk claims (Petts and Niemeyer 2004). Related to this, organizations campaigning against, rather than for, scientific scrutiny of risk claims emerged in the mid-2000s, such as the Science Media Centre. On the other hand, it may have been that the focus for amplification had shifted towards different issues to which our attention wasn't drawn. So, we sought to establish whether we could empirically substantiate both an original high-point of amplification and then a period of de-amplification.

The study was conducted in something of a research vacuum despite, with few precedents. The literature on media and risk is voluminous, but the majority are single case studies rather than a longitudinal analysis, as is the focus here. A further issue is that media studies and risk studies have remained separate (Zinn and Macdonald 30). Bakir (2010) consolidates disparate research on risk and the media to illustrate the emergent theorisation on their relationship. A few studies have examined trends as risk 'storms' or 'waves' (van Atteveldt et al. 2018). The origins and template of the journalistic narrative of risk are set out by Mairal (2011). What has only recently begun to develop pioneered by Zinn are studies that consider the changing nature of risk related reporting over time, across issues. Zinn and Macdonald (2018) analyse risk as it appears and changes in the pages of the New York Times between 1987 and 2014 fusing linguistic analysis with risk research.

Methods

The first step of this study was to develop a corpus of health risk news from British newspapers, before investigating the units of amplification under the Information Mechanism of SARF. The corpus of British risk reporting was built using the archive of daily British newspapers available through Lexis-Nexus. A series of keywords and Boolean operators were used to generate a corpus (n=66,274) of news articles across four distinct fields of health risk [INSERT TABLE 1 NEAR HEAR]. Data was collected between January 1 until December 31 for each year between 1985-2017 and across each of the four fields of health risk. Returned results were downloaded, imported into NVivo 12, and arranged by year and popular field of health risk. The volume of information was assessed by counting the number of risk-based news articles over time for each of the popular fields of health risk. The data from the count of risk-based news was entered into SPSS, where a Kruskal-Wallis test was performed to test if there were significant differences in the volume of risk-based news stories between different time periods. A linear regression analysis was also performed within the different periods of risk reporting to assess the proliferation of risk-based news over time.

The *sensationalisation* of risk information was investigated by performing a word count analysis which targeted *alarming* and *reassuring* language. Synonyms for ‘alarm’ and ‘reassure’ were obtained from an online resource to better reflect a broader use of language within news texts (INSERT TABLE 2 NEAR HERE). While it was intended for ten different synonyms to be analysed, only those highlighted here were expressed at any notable rate. The analysis was performed upon the corpus across each year consecutively.

The *politicisation* of risk information was similarly assessed using a word count analysis, over time, of phrases which commonly denoted socio-political actors involved within policy disputes (INSERT TABLE 3 NEAR HERE). This was achieved by performing a word count analysis for each year which highlighted the top fifty common phrases and isolating those which referred directly to socio-political across. Although “Public” was identified, this was difficult to investigate as the phrase could refer to both the general public, and institutional organisations which have “public” in their name (i.e. Public Health England).

Content analyses was performed using a framing analysis which captured units of amplification under the Response Mechanism of SARF (INSERT TABLE 4 NEAR HERE). Gamson and Modigliani’s (1989) codebook which identifies common frames within reporting around health risks was used as a template within the analysis as the units of amplification mapped well onto the pre-established frames and the original codebook demonstrates some longitudinal validity (Nisbet, 2009). The framing analysis was conducted upon articles published within 16 news-cycles of potential amplified reporting (n=1,490), evenly distributed between the four fields of risk reporting. These were identified by notable peaks in reporting observed during analysis of the Information Mechanism of SARF.

Results and Discussion

Outlining Periods and Trends in Reporting

When analysing the volume of published articles, four distinct periods of risk reporting become apparent between 1985-2017 (INSERT FIGURE 1 NEAR HERE). Each period appears to be characterised differently, suggesting that the journalistic process of risk amplification maybe embedded within temporal conventions (and demands) regarding news-work. When viewed in concert, units of analysis under the Information Mechanism of SARF supports claims that there was an uncharacteristic focus upon alarmist reporting in the late 90s / early 00s which appears to draw upon political aspects of risk management. Furthermore, there is evidence to suggest that from the late 2000s onwards, reporting became less alarmist and more focused upon scientific interpretations of risk information.

Analysing the volume of published health risk-based news revealed that each period reflects characteristics which appears to coarsely describe a trend in the press’ interest in risk reporting over time. The first period of risk reporting (1985-1994) was characterised by a comparatively low volume and low proliferation of news stories, possibly due to a lack of understanding as to the value of health risk reporting within the wider news offering. The second period of risk reporting (1995-2004) is characterised by a rapid proliferation of news stories, suggesting that

newspapers began to dedicate significant resources to covering health risks. The third period of risk reporting (2005-2014) is characterised by a high volume of news stories, but a low proliferation of stories. This data does not provide any evidence to explain why the proliferation of risk reporting declined in the third period and further points towards events at the temporal boundary between the second and third period as likely having an impact. A Kruskal wallis test confirmed that significant differences in the volume of risk reporting was observed at ten- and fifteen-year intervals, but not at five-year intervals. Using the ten-year intervals to define periods allows more comparative moments for analysis, and also permitted a fourth period of risk reporting (2016 - onwards) to be established. **[MP10] The data from the fourth period presently suggests a substantial decline in risk reporting, which may be due to a redistribution of newspaper resources to focus on more resonant issues, particularly the Brexit vote and election of Donald Trump.**

Temporal changes to the volume of reporting within the different fields of health risk were also observed and provides evidence to suggest that the value of different risk profiles varies over time. (INSERT FIGURE 2 NEAR HERE). Food Alert stories grew from 30.5% to 51.1% of the corpus between the first and the fourth periods. Environmental Pollution stories increased from 20.2% to 27.5% of the corpus between the second and fourth periods. Vaccine and Disease stories decreased from 16.9% to 14.5% between the first and second period but increased to 22.9% in the third period. Radiation Risk stories continually declined from 22.0% to 9.2% between the first and fourth period. This data suggests that there was a focus on event-led (scandal) reporting within the initial (first and second) periods that produced a cascade of high-volume reporting that was limited to specific news cycles.

Within the latter (third and fourth) periods, a shift appears towards issue-led (lifestyle) reporting where newspapers sustained a focus on general health risks thought to resonate better with their audience. This is evidenced by the increase in diet- and climate-focused reporting over time. Further analysis confirmed that the proportion of diet-based stories increased from 32.7% to 42.2% of Food Alert reporting between the earlier and latter periods. Similarly, climate-based reporting increased from 5.8% to 18.4% of Environmental Pollution reporting between the earlier and latter periods. One possible reason for the move towards issue-led reporting may be that journalists have improved access to information sources which has encouraged broader news selection, rather than having to rely upon direct information of developing stories from newswires or individual news sources. For example, within Food Alert and Environmental Pollution stories, it was observed that novel classes of news sources (such as lifestyle gurus, celebrities, and non-profit organisations) became more apparent within the latter periods. Conversely, reporting on Vaccine and Disease and Radiation Risk stories mostly relied upon established classes of news source such as healthcare experts, politicians, and victims. Novel classes of news sources may be actively producing messaging designed to attract press attention around particular issues, while more traditional classes of news source are more reliant upon being approached by journalists seeking information in response to a particular event.

Linguistic changes over time

Within the analysis of *sensationalist language*, it was expected that *alarming phrases* would be more commonly expressed than *reassuring phrases*. Overall, a T-test confirmed significant press bias ($p=0.05$) towards *alarming phrases* (56.9%) over *reassuring phrases* (43.1%). Generally,

the yearly median difference between *alarming* and *reassuring phrases* was calculated to be 32.2%. Within the first period, slightly more *reassuring phrases* were observed than expected (23.1% median difference). Within the second period, an uncharacteristically high expression of *alarming phrases* was observed (51.3% median difference). Within the third period, the expression of both *alarming* and *reassuring phrases* roughly corresponded with expectations (33.8% median difference). Within the fourth period, expression of *alarming* and *reassuring phrases* appears to have reached a level of near parity (0.3% median difference). The uncharacteristically high expression of *reassuring phrases* in the fourth period is a novel finding, however further research is required to better substantiate this claim.

The analysis of *politicising language* identified three key thematic categories: (1) *Institutional Sources* – a dichotomy between Government sources or Scientific sources of information. (2) *Institutional Actors* – elite classes of actor likely to influence policy decisions on risk governance. (3) *Institutional Publication* – a dichotomy between Government reports and Scientific research papers. When analysing *institutional sources*, the proportion of attributions to Government sources declined from 67.8% to 37.6% over time, while Scientific sources increased from 37.6% to 62.4%. Analysis of *Institutional Actors* demonstrated that, across the reporting periods, references to Government Ministers declined from 47.2% to 23.6%, references to Scientific Experts increased from 30.1% to 46.3%, and references to Industry Chiefs increased from 22.7% to 30.1%. Analysis of *Institutional Publications* demonstrated that, across the reporting periods, attributions to Government Reports declined from 63.3% to 48.7%, and Scientific Reports increased from 36.7% to 51.3%.

The analysis of *politicising language* seemingly demonstrates a shift within source selection over time, with journalists more likely to choose political information sources within the earlier periods and scientific information sources in the latter periods. It further appears that the shift towards science-driven reporting occurred around the temporal boundary between the second and third periods. A shift towards science-driven reporting may have also influenced the depressed expression of *alarming* phrases within the latter periods, as scientific experts conventionally use tentative language when disseminating information (Nielsen, 2015). Analysis of modal verbs provides some evidence to support this observation, as the expression of more-certain modal verbs (e.g. ‘can cause’ and ‘may cause’) declined from 0.6 to 0.4 mentions per article between the second and third periods. One possible explanation for the uncharacteristically high expression of *alarming* language in the second period maybe related to the profile of statements provided by *Non-Institutional Actors* (e.g. ‘campaigners’, ‘parents’ and ‘victims’). Analysis confirmed that, over time, the difference in references between *Non-Institutional Actors* and *Institutional Actors* increased from 0.2% to 61.96%. Such data suggests that the second period was a moment where socio-political tensions around risk governance were readily depicted within the press, possibly to provide a simulacrum of reasoned public debate.

Framing changes over time

Analysis of risk amplifying news frames revealed a notable division of expression which permitted categorisation of frames. The major amplifying frames included Uncertainty (40.4%), Certainty (22.6%) and Blame (16.9%). The minor frames included Dread (7.1%), Trust (6.5%),

Stigma (6,4%). The expression of risk amplifying frames typically ranged from between: 43% to 45% for Uncertainty, 20% to 23% for Certainty and 13% to 16% for blame. Within the second period, a unique profile was observed where expression of Certainty (26%) and Blame (20.9%) was uncharacteristically high and Uncertainty (31.2%) was uncharacteristically low (INSERT FIGURE 3 NEAR HERE), The uncharacteristic profile of risk amplifying frames within the second period suggests that source selection may have a profound impact on the amplification (and de-amplification) of risk within news stories. During the analysis, the majority of frames were coded within statements from news sources published within news articles. The selection of news sources within the second period was inclined to balance two opposing positions around socio-political tensions and risk governance. Generally, this took the form of contrasting safety assurances (Certainty) from *Institutional* (ministerial) sources alongside accusations (Blame) and direct claims of harm (Certainty) from *Non-Institutional* sources. The uncharacteristic expression of Certainty and Blame frames within the second period suggests that there was either a shift in how news sources were selected, or there was something particular in how news sources communicated with the press during this period. When the framing analysis is considered alongside the data from the linguistic analysis, there is evidence to suggest that when expression of Blame and Certainty is elevated (and Uncertainty suppressed) within news reporting, this indicates a temporal moment of high risk amplification. The remainder of this study will analyse the general characteristics for each of the four periods and suggest how some of the impactful risk events may have facilitated paradigmatic changes to the conventions of risk-based news work.

The first period (1985-1994): placing risk on the public agenda

It was during the first period of risk reporting that reporters began to develop a media template of amplified risk reporting. Kitzinger (2000) describes media templates as standardised approaches to news-work which produce narratives that aid public sensemaking around complex issues. The Chernobyl Disaster (1986) marked a turning point by highlighting the value of risk reporting to the press. Prior to Chernobyl, the British press did not appear to emphasise health risks within newspapers (Royal Society, 1985). Chernobyl reporting provided the opportunity to simplify the complex array of technical, social, and geopolitical concerns to make issues around risk governance *relatable* to their audiences (Hornig, 1992). Frames such as Uncertainty and Blame underscored much of the reporting, as reporters attempted to decipher technical safety reports and were confronted by an information vacuum from the government (Clark, 1986, Rubin, 1987). The value of scientific news sources was affirmed, helping journalists contextualise information and chastise the government for (seemingly) improper risk responses.

The media template towards risk was more clearly established over the prolonged course of coverage of the BSE crisis (1989-2001). Dr Richard Lacey was a media-friendly scientific contact who generated news based upon his open refutation of Government safety assertions regarding British beef. Government safety assertions were observed to be a common source of Certainty as ministers claimed that their assertions were backed by scientific evidence, but often failed to present any data. Statements provided by Dr Lacey, among other scientists, questioned the completeness of scientific investigation into the safety of British Beef and claimed that the Government manipulated data to suit their economic agenda (Miller, 1999). Such statements were coded as Uncertainty and Blame within the framing analysis. The press generally supported

Dr Lacey's claims against the government by utilising his statements to supplement stories published across the 1990s which highlighted victimised children. Furthermore, these stories often included statements from distraught parents who blamed the Government for prioritising agricultural profits over public safety.

The second period (1995-2004): campaigning on risk for news audiences

The Government's admission, in 1996, that there was a link between BSE and nCJD marked a key press victory which encouraged journalists to act as self-appointed public watchdogs over risk governance. Developed from a journalistic perspective that increasingly regarded permissive policies around (seemingly) risky technologies as *potential* scandals (Bauer *et al.*, 2006), a media template emerged composed of the following elements:

- (1) Parental / pressure group concern over risks to children,
- (2) Government safety assurances over the safety of an identified technology,
- (3) potential profit generating potential for industry or cost saving potential for government,
- (4) Dissident scientific sources which dispute / refute the government's claims.

These elements were evident across a range of technologies including mobile phone radiation, MMR, GMO crops, and depleted uranium ammunition. The apparent intent - as often stated by parental / pressure group news sources - was to mount public pressure upon government to block, ban, or otherwise limit seemingly risky technologies. Risk narratives were characteristically polarised battles between government and the public.

The MMR coverage (2001-2002) was a key event that fractured the new media template and marked a paradigmatic shift in reporting conventions. From the outset, the MMR story corresponded well with the media template on risk, involving:

- (1) potential risks from a novel technology that primarily impacted children,
- (2) refutations of government safety assurances by a dissident scientific expert,
- (3) active campaigning by a pressure group led by a parent of a (purportedly) victimised child,
- (4) the opportunity for government cost-saving by withdrawing the single vaccine schedule from the NHS.

However, unlike the BSE reporting, the press were not unified against the Government's safety assertions. Left-leaning newspapers (such as the *Guardian* and the *Independent*) advocated the safety of MMR, while right-leaning papers (such as the *Daily Mail* and the *Times*) advocated parental choice for single vaccinations. Meanwhile, the *Express* campaigned explicitly on protecting children from the risks of autism from MMR. Despite the popular attraction of right-leaning reporting, the pedigree of scientific sources selected by left-leaning newspapers provided them with a competitive advantage as they could consistently publish informative stories to support the argument that MMR was safer than the alternative.

The third period 2005-2014: a turn towards scientific risk reporting

Changes to the media template on risk appear as established press conventions by the mid-00s and involved the following elements:

- (1) novel measurements of risk,
- (2) contextualising risk information through scientific balance / consensus,
- (3) fulfilling gaps in public knowledge / policy oversight,
- (4) actionable strategies to manage risk.

This template marks a novel change in the relationship between the press and scientific institutions that leans towards symbiotic support (Clarke *et al.*, 2015). For scientific institutions, the press seemingly provided a means to aid the dissemination of research/information and boost public profile in a post-BSE environment of heightened sensitivity towards perceived public mistrust. This working relationship appears directly attributable to the recommendations made within the House of Lords (2000) report, and the work of organisations such as the SMC (Fox 2011). There were significant changes in the characterisation of events which held the potential for amplification. Reporting on the Swine Flu Pandemic (2009), Fukushima Disaster (2011) and The Horse Meat Scandal (2013) appear to be de-amplified compared to thematically similar events in the earlier periods. This is not to suggest that risks were attenuated within the media by being downplayed or suppressed. Rather, the story focus mostly centres on identifying regulatory / policy failures instead of blaming the government for failing to ensure public safety. Where risks were identified, they were often contextualised against relative risk information then juxtaposed against statements which widened discourses around resource allocation, demography and victimisation, and risk as a product of neoliberalism. Coming to view government as a willing social partner then involves two inter-related approaches to risk-based newswork. One approach acknowledges that risk is produced and distributed by the techno-social systems of neoliberalism, which can be addressed through cosmopolitan engagement during policy design (Beck, 2006). Whereas the second approach cast risk as a cautionary tale, providing information for readers to incorporate into their own lifestyle to try and reduce their risk exposure.

Fourth Period (2015 – onwards): criticising risk governance

While data on the fourth period is more limited, the framing analysis did provide qualitative evidence to suggest that the remainder of the period will follow a trajectory that de-emphasises the role of individual risk management, while emphasising narratives which are critical of institutional governance of risk. For example, reporting on **the Zika virus and Rio Olympics (2016) and the European Toxic Egg Scandal (2017) much of the reporting focused on how governing bodies attempted to manage risk.** A specific emphasis was placed on the role of neoliberal consumerism and the inequitable distribution of risk between social/geographical demographics. Furthermore, statements provided by scientific sources appeared more likely to provide prescriptive policy advice presumed to lower rates of victimisation, while being more inclined to castigate policy makers for short-sighted policy design. It is suggested that the media template may currently be undergoing some change produced by a reorientation in how scientific experts view their contributions to wider public discourses on risk. Furthermore, journalists may

be altering the media template by selecting politically charged scientific sources and presenting their policy recommendations as derived from an established scientific consensus.

The use of *Non-Institutional* news sources has become unfashionable within risk reporting, this may skew mediated public discourses to suggest that those with technical expertise to define risk also hold the appropriate knowledge on how best to manage it. For example, those who ignored public safety advice during the COVID-19 pandemic were publicly shamed as #COVIDIOT[s] on social media. Whilst journalists within a liberal democracy may be expected to provide balance to news stories, recent newsroom cutbacks may have encouraged news-work which swiftly publish pre-packaged stories based upon institutional press releases (Winters *et al*, 2019). Sumner *et al* (2016) and Schat *et al* (2018) suggest that contemporary journalists are not overly critical or discerning of information embedded within institutional press releases, while Lewis *et al* (2006) highlights how institutional press releases often contain all the information, statements and quotes needed for journalists to write stories without needing further contact.

Conclusions

Using the SARF framework to guide analysis within a large corpus of risk-based news reporting, this study provides empirical evidence of there has indeed been change in the degree and character of amplification over time. Evidence suggests that a peak period of amplification across the late 1990s and early 2000s was predicated upon newspapers assuming a risk campaigning role which was subsequently relinquished and even reversed. Furthermore, our interpretation of the data tentatively suggests four distinct periods of risk reporting, since the mid-1980s, shaped by changing journalistic practices such as campaigning on behalf of presumed audience values, access to scientific sources, and highlighting failures of risk governance.

The first period (1985-1994) describes a phase where reporters became more aware of a media market interested in stories about how the government was unable, or unwilling, to ensure the safety of novel applied technologies. It was characterised by prominent expression of uncertainty frames as journalists began to encounter conflicting information from news sources over levels of risk and safety. In the second period (1995-2004) reporters assumed a role of public risk watchdog, campaigning on behalf of their audience to contrast government safety assurances against risk-claims from non-institutional sources. This approach to reporting resulted in a proliferation of reporting which amplified risk through the use of alarming language and presenting of risk discourses as a political conflict between government and the public. The third period (2005-2014) describes a phase of risk de-amplification where reporters focused upon balancing information from credible scientific sources to better manage a range of lifestyle and environmental risks. Highlighting scientific experts as institutional sources de-amplified by introducing more tentative language into news stories that was less-certain of causal links between a risk object and harm, while also being less inclined to blame the government of intentional malfeasance. A fourth period (2015-) describes a contemporary phase where the profile of risk amplification is more ambiguous. While journalists continued to draw upon scientific expertise within reporting, credible sources increasingly included prescriptive policy in advice in their statements to the press when highlighting where government policy is failing to appropriately

manage risks. This development may be counter-intuitive for public acceptance of evidence-based reporting by echoing concerns over the politicisation of science which were apparent within earlier reporting periods.

This study addresses a gap in existing knowledge by conducting a robust longitudinal analysis of news texts to highlight some of the key changes in risk reporting. Furthermore, this study describes a method of analysis by which corpus-based research can be used to identify previously under-explored media events around risk and uncertainty. However, there were limitations to the study. Building the corpus relied on 'Risk' as a target. Other phrases, such as 'Danger' or 'Hazard' may be used by journalists / sources to imply riskiness within reporting. Due to concerns over linguistic ambiguity and time constraints, other target phrases were discounted from corpus building. Further research might find value in repeating our method using different target phrases, while psychometric analysis might benefit from investigating the perceived riskiness of target phrases.

Similarly, quantitative analysis relied on wordcount methods which omit context. Whilst the framing analysis was intended to compensate for the lack of context, our method would benefit greatly from linguistic analysis software which better captures affective dimensions of text. Another limitation is that this study discounted online news (and social media) platforms. There were several methodological issues which omitted their inclusion from this study. Firstly, it cannot be presumed that the modes of news-work are comparable between physical and virtual news production. Secondly, the poor state of internet archival pose challenges for corpus-based research as content can be edited/deleted post-publication and missed from data gathering. Thirdly, without arbitrarily defining what constitutes as 'news', the scope of available sources which could be included in a data set is staggering and would demand bespoke technical methods to access and retrieve text for analysis.

We end by acknowledging that there is overlap between the periods identified here and that the themes and characteristics are clearly not unique to them. There is both continuity and change, as always. We are describing tendencies and shifts of balance between one emphasis and another. More generally we acknowledge that our findings are tentative and remain subjective. Whilst our temporal analysis is based upon substantial data the delineation retains a subjective dimension, particularly regarding the precision of change from the end of one phase and the start of another. We hope that this study will encourage further research to take analysis of this important area further.

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Tables and Figures

Type of Health Risk	Term 1	Boolean	Term 2	Boolean	Term 3	Boolean	Term 4
Food Alerts	Food	OR	Diet	AND	Health	AND	Risk
Radiation Risks	Radiation	OR	Nuclear	AND	Health	AND	Risk
Disease & Vaccine	Disease	OR	Vaccine	AND	Health	AND	Risk
Environmental Pollution	Environment	OR	Pollution	AND	Health	AND	Risk
Table 1 String of search terms, including Boolean operators, used within this study.							

<i>Alarming phrases</i>	<i>Reassuring phrases</i>
Alarm	Reassure
Scare	Secure
Danger	Safe

Table 2 - List of popular synonyms for *alarming* and *reassuring* phrases, acquired from powerthesaurus.org

Common Politicising Phrases	
Thematic Cluster	Constituent Phrases
Institutional source	Government Science & Scientist
Institutional actor	Government & Minister Science & Expert Industry & Chief
Institutional publication	Government & Report Science & Research
Table 3. List of popular phrases which denoted special political actors within the corpus of health risk reporting.	

Original Frame	SARF Frame	Defines Risk-related issues as...
Scientific / technical uncertainty	Uncertainty	... what is unknown; either invokes or undermines expert consensus; calls the authority of “sound science”, falsifiability, or peer-review
Scientific / technical uncertainty	Certainty	... what is known; either invokes or undermines expert consensus; calls on the generalisability of lived experiences, social facts, or “common sense”
Conflict / Strategy	Blame	...a game among elites and social groups; who is winning the debate; battle of personalities
Morality/ethics	Dread	...in terms of right or wrong; involuntary; crossing limits, thresholds or boundaries
Public accountability	Trust	...responses which serve public benefit; a matter of solidarity and/or philanthropy; responsible use of science in decision making
Runaway science	Stigma	...calls for precaution in the face of possible catastrophe; out of control; unnatural

Table 4. Adaptations of Gamson and Modigliani’s (1989) list of common media frames regarding to better capture aspects of risk amplification suggested by SARF.

Figure 1

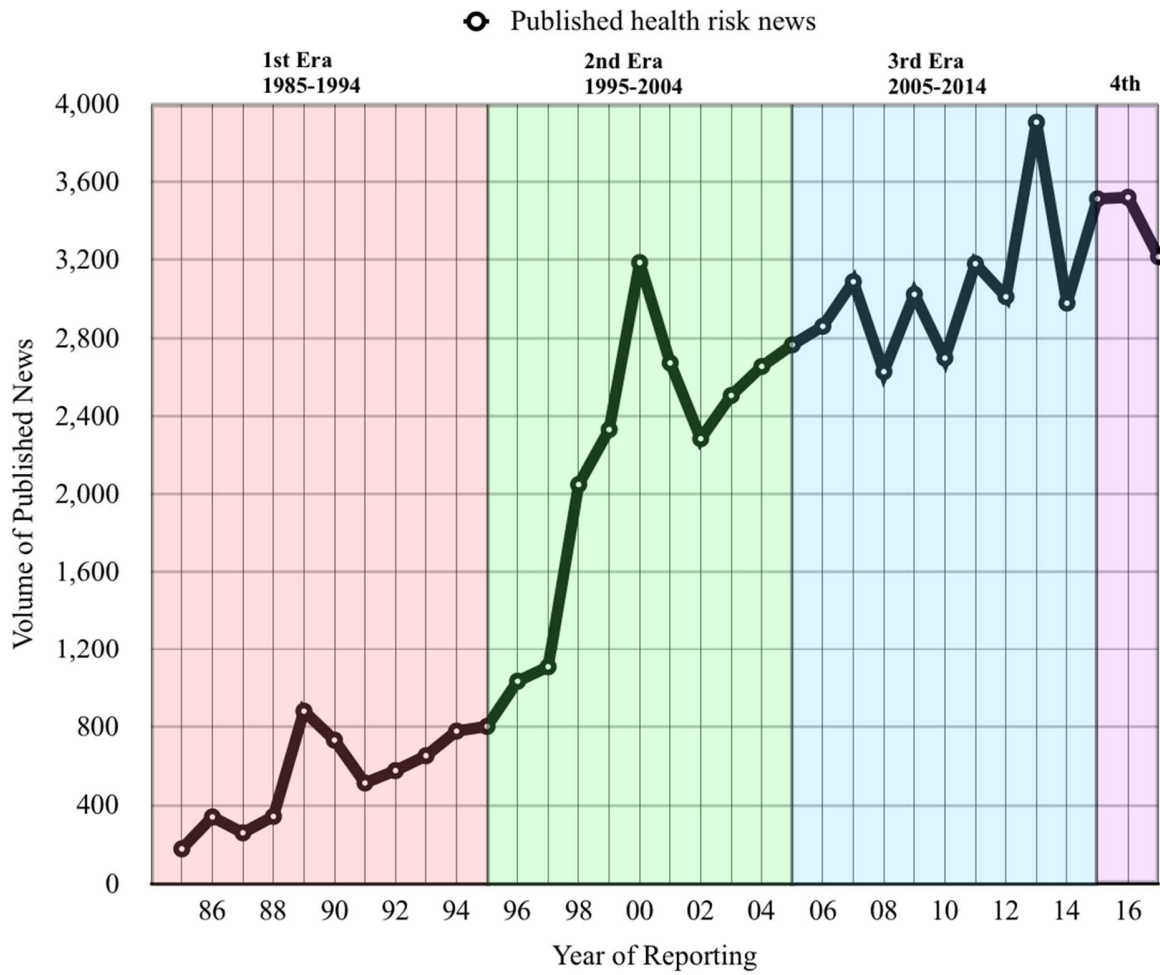


Figure 2

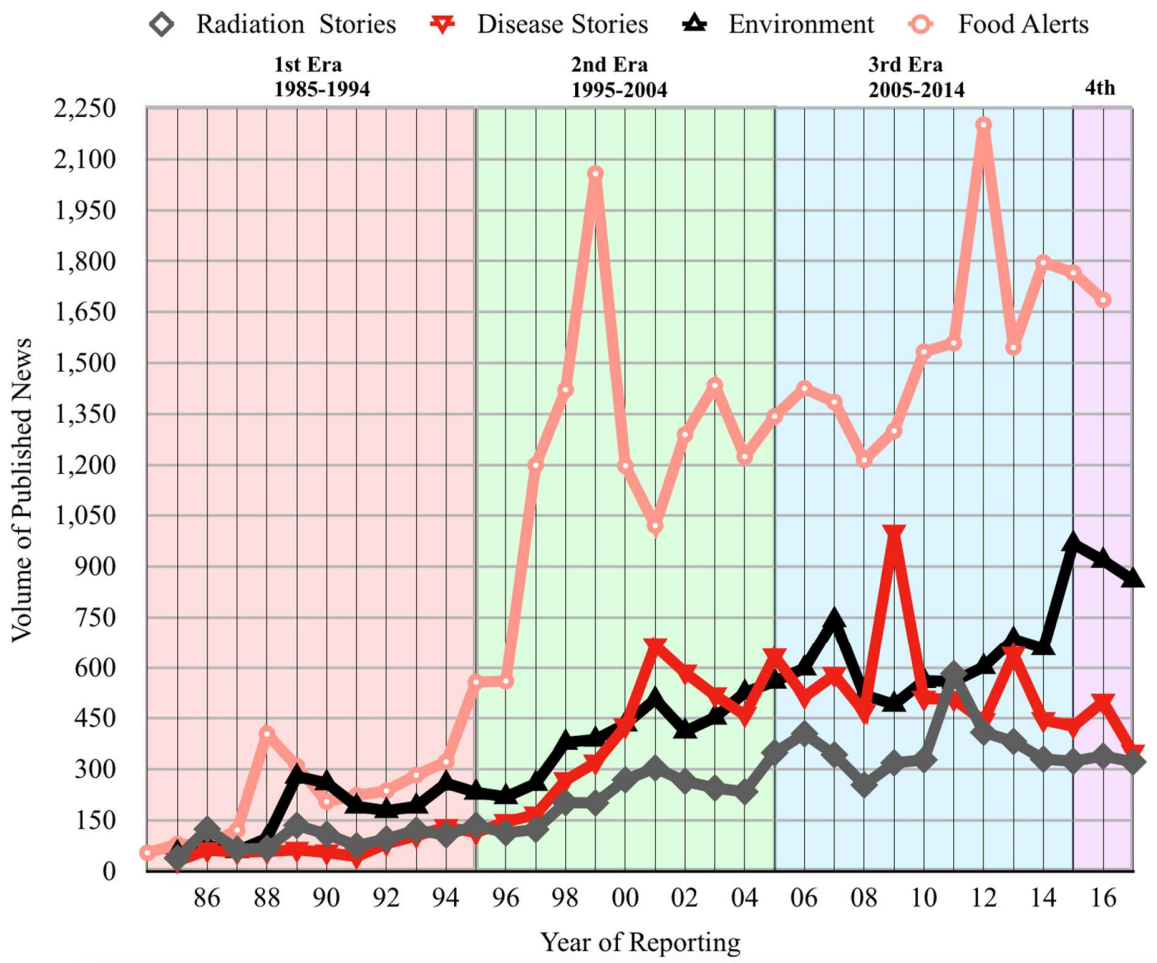


Figure 3

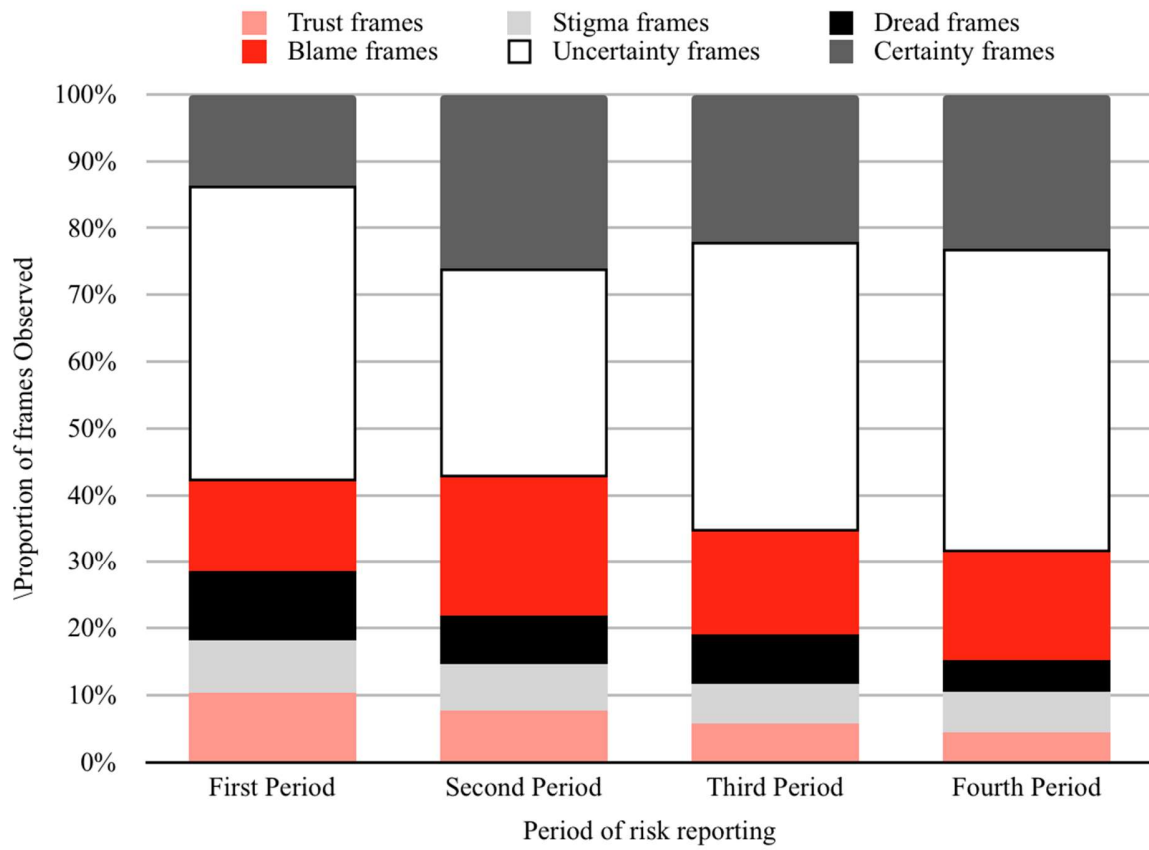


Figure captions

Figure 1. Yearly volume of health risk reporting published by the British press between 1985-2017. The different periods of risk reporting are marked as temporal moments where changes in the proliferation and volume of reporting may indicate further changes to the standard media conventions regarding risk reporting.

Fig 2. Line graph of the volume of published risk-based news for four popular fields of science reporting. Across the periods of risk reporting, notable peaks in reporting become apparent for each field of reporting, suggesting different temporal contexts where observable changes in media approaches to risk reporting may be most apparent.

Fig 3. Proportional expression of risk amplifying frames across a sample of 1,490 news articles published during moments of peak risk reporting.