Nothing but the truth

Are the media as bad at communicating science as scientists fear?

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Everything gives you cancer, at least if you believe what you read in the news or see on TV. Fortunately, everything also cures cancer, from red wine to silver nanoparticles. Of course the truth lies somewhere in between, and scientists might point out that these claims are at worst dangerous sensationalism and at best misjudged journalism. These kinds of media story, which inflate the risks and benefits of research, have led to a mistrust of the press among some scientists. But are journalists solely at fault when science reporting goes wrong, as many scientists believe [1]? New research suggests it is time to lay to rest the myth that the press alone is to blame. The truth is far more nuanced and science reporting can go wrong at many stages, from the researchers to the press officers to the diverse producers of news.

Many science communication researchers suggest that science in the media is not as distorted as scientists believe, although they do admit that science reporting tends to under-represent risks and over-emphasize benefits [2]. "I think there is a lot less of this [misreported science] than some scientists presume. I actually think that there is a bit of laziness in the narrative around science and the media," said Fiona Fox, Director of the UK Science Media Centre (London, UK), an independent press office that serves as a liaison between scientists and journalists. "My bottom line is that, certainly in the UK, a vast majority of journalists report science accurately in a measured way, and it's certainly not a terrible

story. Having said that, lots of things do go wrong for a number of reasons."

Fox said that the centre sees everything from fantastic press releases to those that completely misrepresent and sensationalize scientific findings. They have applauded news stories that beautifully reported the caveats and limitations of a particular scientific study, but they

admitting that is admitting more complexity. So anyone who says that scientists and university press officers deliver perfectly accurate science and the media misrepresent it [...] that really is not the whole story."

Scientists and scientific institutions today invest more time and effort into communicating with the media than they did a decade ago, especially given the modern emphasis on communicating scientific results to the public [3]. Today, there are considerable pressures on scientists to reach out and even 'sell their work' to public relations officers and journalists. "For every story that a journalist has hyped and sensationalized, there will be another example of that coming directly from a press release that we [scientists] hyped and sensationalized," Fox said. "And for every time that that was a science press officer, there will also be a science press officer who will tell you, 'I did a much more nuanced press release, but the academic wanted me to over claim for it.'"

Although science public relations has helped to put scientific issues on the public agenda, there are also dangers inherent in the process of translation from original research to press release to media story. Previous research in the area of science communication has focused on conflicting scientific and media values, and the effects of science media on audiences. However, studies have raised awareness of the role of press releases in distorting information from the lab bench to published news [4].

have also cringed as a radio talk show pitted a massive and influential body of research against a single non-scientist sceptic.

"You ask, is it the press releases, is it the universities, is it the journalists? The truth is that it's all three," Fox said. "But even

In a 2011 study of genetic research claims made in press releases and mainstream print media, science communication researcher Jean Brechman, who works at the US advertising and marketing research firm Gallup & Robinson, found evidence that scientific knowledge gets distorted as it is “filtered and translated for mass communication” with “slippages and inconsistencies” occurring along the way, such that the end message does not accurately represent the original science [4]. Although Brechman and colleagues found a concerning point of distortion in the transition between press release and news article, they also observed a misrepresentation of the original science in a significant portion of the press releases themselves.

In a previous study, Brechman and his colleagues had also concluded that “errors commonly attributed to science journalists, such as lack of qualifying details and use of oversimplified language, originate in press releases.” Even more worrisome, as Fox told a *Nature* commentary author in 2009, public relations departments are increasingly filling the need of the media for quick content [5].

Fox believes that a common characteristic of misrepresented science in press releases and the media is the overclaiming of preliminary studies. As such, the growing prevalence of rapid, short-format publications that publicize early results might be exacerbating the problem. Research has also revealed that overemphasis on the beneficial effects of experimental medical treatments seen in press releases and news coverage, often called ‘spin’, can stem from bias in the abstract of the original scientific article itself [6]. Such findings warrant a closer examination of the language used in scientific articles and abstracts, as the wording and ‘spin’ of conclusions drawn by researchers in their peer-reviewed publications might have significant impacts on subsequent media coverage.

Of course, some stories about scientific discoveries are just not easy to tell owing to their complexity. They are “messy, complicated, open to interpretation and ripe for misreporting,” as Fox wrote in a post on her

blog *On Science and the Media* (fionafox.blogspot.com). They do not fit the single-page blog post or the short press release. Some scientific experiments and the peer-reviewed articles and media stories that flow from them are inherently full of caveats, contexts and conflicting results and cannot be communicated in a short format [7].

In a 2012 issue of *Perspectives on Psychological Science*, Marco Bertamini at the University of Liverpool (UK) and Marcus R. Munafo at the University of Bristol (UK) suggested that a shift toward “bite-size” publications in areas of science such as psychology might be promoting more single-study

models of research, fewer efforts to replicate initial findings, curtailed detailing of previous relevant work and bias toward “false alarm” or false-positive results [7]. The authors pointed out that larger, multi-experiment studies are typically published in longer papers with larger sample sizes and tend to be more accurate. They also suggested that this culture of brief, single-study reports based on small data sets will lead to the contamination of the scientific literature with false-positive findings. Unfortunately, false science far more easily enters the literature than leaves it [8].

One famous example is that of Andrew Wakefield, whose 1998 publication in *The Lancet* claimed to link autism with the combined measles, mumps and rubella (MMR) vaccination. It took years of work by many scientists, and the aid of an exposé by British investigative reporter Brian Deer, to finally force retraction of the paper. However, significant damage had already been done and many parents continue to avoid immunizing their children out of fear. Deer claims that scientific journals were a large part of the problem: “[D]uring the many years in which I investigated the MMR vaccine controversy, the worst and most inexcusable reporting on the subject, apart from the original Wakefield claims in the *Lancet*, was published in *Nature* and republished in *Scientific American*,” he said. “There is an enormous amount of hypocrisy among those who accuse the media of misreporting science.”

What factors are promoting this shift to bite-size science? One is certainly the increasing pressure and competition to publish many papers in high-impact journals, which prefer short articles with new, ground-breaking findings.

“Bibliometrics is playing a larger role in academia in deciding who gets a job and who gets promoted,” Bertamini said. “In general, if things are measured by citations, there is pressure

to publish as much and as often as possible, and also to focus on what is surprising; thus, we can see how this may lead to an inflation in the number of papers but also an increase in publication bias.”

Bertamini points to the real possibility that measured effects emerging from a group of small samples can be much larger than the real effect in the total population. “This variability is bad enough, but it is even worse when you consider that what is more likely to be written up and accepted for publication are exactly the larger differences,” he explained.

Alongside the endless pressure to publish, the nature of the peer-reviewed publication process itself prioritizes exciting and statistically impressive results. Fluke scientific discoveries and surprising results are often

considered newsworthy, even if they end up being false-positives. The bite-size article aggravates this problem in what Bertamini fears is a growing similarity between academic writing and media reporting: “The general media, including blogs and newspapers, will of course focus on what is curious, funny, controversial, and so on. Academic papers must not do the same, and the quality control system is there to prevent that.”

The real danger is that, with more than one million scientific papers published every year, journalists can tend to rely on only a few influential journals such as *Science* and *Nature* for science news [3]. Although the influence and reliability of these prestigious journals is well established, the risk that journalists and other media producers might be propagating the exciting yet preliminary results published in their pages is undeniable.

Fox has personal experience of the consequences of hype surrounding surprising but preliminary science. Her sister has chronic fatigue syndrome (CFS), a debilitating medical condition with no known test or cure. When *Science* published an article in 2009 linking CFS with a viral agent, Fox was naturally both curious and sceptical [9]. “I thought even if I knew that this was an incredibly significant finding, the fact that nobody had ever found a biological link before also meant that it would have to be replicated before patients could get excited,” Fox explained. “And of course what happened was all the UK journalists were desperate to splash it on the front page because it was so surprising and so significant and could completely revolutionize the approach to CFS, the treatment and potential cure.”

Fox observed that while some journalists placed the caveats of the study deep within their stories, others left them out completely. “I gather in the USA it was massive, it was front page news and patients were going online to try and find a test for this particular virus. But in the end, nobody could replicate it, literally nobody. A Dutch group tried, Imperial College London, lots of groups, but nobody could replicate it. And in the end, the paper has been withdrawn from *Science*.”

For Fox, the fact that the paper was withdrawn, incidentally due to a finding of contamination in the samples, was less interesting than the way that the paper was reported by journalists. “We would want any journal press officer to literally in the first paragraph be highlighting the fact that this was such a surprising result that it shouldn’t be splashed on the front page,” she said. Of course to the journalist, waiting for the study to be replicated is anathema in a culture that values exciting and new findings. “To the scientific community, the fact that it is surprising and new means that we should calm down and wait until it is proved,” Fox warned.

So, the media must also take its share of the blame when it comes to distorting science news. Indeed, research analysing science coverage in the media has shown that stories tend to exaggerate preliminary findings, use sensationalist terms, avoid complex issues, fail to mention financial conflicts of interest, ignore statistical limitations and transform inherent uncertainties into controversy [3,10].

One concerning development within journalism is the ‘balanced treatment’ of controversial science, also called ‘false balance’ by many science communicators.

This balanced treatment has helped supporters of pseudoscientific notions gain equal ground with scientific experts in media stories on issues such as climate change and biotechnology [11].

“Almost every time the issue of creationism or intelligent design comes up, many newspapers and other media feel that they need to present ‘both sides’, even though one is clearly nonsensical, and indeed harmful to public education,” commented Massimo Pigliucci, author of *Nonsense on Stilts: How to Tell Science from Bunk* [12].

Fox also criticizes false balance on issues such as global climate change. “On that one you can’t blame the scientific community, you can’t blame science press officers,” she said. “That is a real clashing of values. One of the values that most journalists have

bred into them is about balance and impartiality, balancing the views of one person with an opponent when it’s controversial. So on issues like climate change, where there is a big controversy, their instinct as a journalist will be to make sure that if they have a climate scientist on the radio or on TV or quoted in the newspaper, they pick up the phone and make sure that they have a climate skeptic.” However, balanced viewpoints should not threaten years of rigorous scientific research embodied in a peer-

reviewed publication. “We are not saying generally that we [scientists] want special treatment from journalists,” Fox said, “but we are saying that this whole principle of balance, which applies quite well in politics, doesn’t cross over to science...”

Bertamini believes the situation could be made worse if publication standards are relaxed in favour of promoting a more public and open review process. “If today you were to research the issue of human contribution to global warming you would find a consensus in the scientific literature. Yet you would find no such consensus in the general media. In part this is due to the existence of powerful and well-funded lobbies that fill the media with unfounded skepticism. Now imagine if these lobbies had more access to publish their views in

the scientific literature, maybe in the form of post publication feedback. This would be a dangerous consequence of blurring the line that separates scientific writing and the broader media."

In an age in which the way science is presented in the news can have significant impacts for audiences, especially when it comes to health news, what can science communicators and journalists do to keep audiences reading without having to distort, hype, trivialize, dramatize or otherwise misrepresent science?

Pigliucci believes that many different sources—press releases, blogs, newspapers and investigative science journalism pieces—can cross-check reported science and challenge its accuracy, if necessary. "There are examples of bloggers pointing out technical problems with published scientific papers," Pigliucci said. "Unfortunately, as we all know, the game can be played the other way around too, with plenty of bloggers, 'twitterers' and others actually obfuscating and muddling things even more." Pigliucci hopes to see a cultural change take place in science reporting, one that emphasizes "more reflective shouting, less shouting of talking points," he said.

Fox believes that journalists still need to cover scientific developments more responsibly, especially given that scientists are increasingly reaching out to press officers and the public. Journalists can inform, intrigue and entertain whilst maintaining accurate representations of the original science, but need to understand that preliminary results must be replicated and validated before being splashed on the front page. They should also strive to interview

experts who do not have financial ties or competing interests in the research, and they should put scientific stories in the context of a broader process of nonlinear discovery. According to Pigliucci, journalists can and should be educating themselves on the research process and the science of logical conclusion-making, giving themselves the tools to provide critical and investigative coverage when needed. At the same time, scientists should undertake proper media training so that they are comfortable communicating their work to journalists or press officers.

"I don't think there is any fundamental flaw in how we communicate science, but there is a systemic flaw in the sense that we simply do not educate people about logical fallacies and cognitive biases," Pigliucci said, advising that scientists and communicators alike should be intimately familiar with the subjects of philosophy and psychology. "As for bunk science, it has always been with us, and it probably always will be, because human beings are naturally prone to all sorts of biases and fallacious reasoning. As Carl Sagan once put it, science (and reason) is like a candle in the dark. It needs constant protection and a lot of thankless work to keep it alive."

CONFLICT OF INTEREST

The author declares that she has no conflict of interest.

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