Emily Wheater // Cases of measles worldwide have quadrupled in the past year. For years we have been waiting to see what the consequences of vaccine scepticism would be. Now that they are apparent, they are as unsurprising as they are alarming.

The issues around why people do or do not vaccinate themselves and their children are complex. That the media played a significant role in stoking up the MMR scare is well-documented. What I want to do here is probe some of the statements that were made about the science and scientists that contributed to the scare. These, I think, have also contributed to the expert scepticism that is rife today.

Many features of the MMR reporting damaged public confidence in the vaccine in the late 90s and early 2000s. The portrayal of Andrew Wakefield as martyr to the medical establishment and the portrayal of that medical establishment as being equally divided in its beliefs were potent factors. But amongst the issues of misrepresentation, there was also the profound problem that inexpert commentators were blithely making statements that appeared to be of fact, but which were instead totally false.

This was particularly potent and evident in writings concerning statistics and the scientific process. In her 2005 article 'MMR safe? Baloney. This is one scandal that's getting worse,' Melanie Phillips writes of vaccinated children: 'Only a very small proportion are said to have been badly affected but population-wide studies are considered too large and insensitive to pick up small numbers such as this.'

Too large? Too insensitive? To speak of a large population study being too big to be sensitive to small numbers is simply nonsensical. It is precisely large, population-level studies that are required to detect small effects. Recently, a research group from Copenhagen published the results from a nationwide cohort study to evaluate the risk of developing autism in association with the MMR vaccine. The authors wrote of their new study: "we aimed to evaluate the association again in a more recent and non-overlapping cohort of Danish children that has greater statistical power owing to more children, more cases, and longer follow-up" [1]. If a study is highly powered, it means that your analysis is more likely to reject the null hypothesis (e.g. that there is no link between autism and the MMR vaccine) *if the alternative hypothesis is true* (e.g. that there is a link between autism and the MMR vaccine). If a very large study, which is highly powered, does not provide evidence that the null hypothesis can be rejected, that is because it is unlikely that the alternative hypothesis is true. It is, contrary to Melanie Phillips' statement, these large studies that

would uncover an association *if such an association existed*. That they haven't demonstrated this association provides strong evidence that the association is unlikely to exist.

Not that this would have caused this particular commentator any hesitation. In 2004 she wrote, "and in any event, these studies do not say there is no link between MMR and autism. They say instead there is no evidence of a link – a very different matter." This formulation could be used to justify a belief in anything. There is no evidence that the moon is made of cheese; this is not a "very different matter" from the belief that the moon is not made of cheese. This demonstration of such a basic ignorance of epidemiology and statistics should never have ended up in print in a national newspaper.

These statements reveal a profound ignorance of the subject under discussion, but how was it that inaccurate and misleading 'opinion pieces' were being written by people completely unqualified to do so? Ben Goldacre comments that: 'Pieces on GM food, or cloning, were twice as likely to be written by specialist science reporters as stories on MMR. With MMR, 80% were written by non-specialist reporters.'

The clue as to why this ended up being the case I think lies somewhere in these words from Peter Hitchens, another journalist who has repeatedly expressed MMR vaccine doubts: "I yield absolutely to scientists on matters in which they are expert. *But I see no reason why they should have special privileges in any argument which can be expressed in unspecialised terms*. They have no special powers of logic, *and their facts are just as easily examined as anyone else's*" (italics added).

The problem is that this is *not* an argument that can be expressed wholly in unspecialized terms. Questions of vaccine safety and efficacy are, in fact, technical questions, which must be expressed in specialised terms; otherwise we end up with inaccuracies such as "population-wide studies are considered too large and insensitive to pick up small numbers." What these commentators failed to recognise, in short, is that while their expertise and experience may enable them to engage in certain types of questions and issues, it does not necessarily equip them to engage competently with questions regarding public health. That blindness is sobering, because its consequences are– quite literally–life-threatening.

The MMR scandal is not over. It catalysed the growth of the anti-vax movement and resulted in the vaccine hesitation and growing rates of preventable infectious diseases that we are seeing today. The original instigator of this sorry story, Andrew Wakefield, has had his paper retracted on the grounds that its findings were fraudulent, and ethics committee approvals were not in place at the time that the research was being carried out. He has been struck off by the UK's General Medical Council. In contrast, many of the journalists who irresponsibly propagated his findings are still writing, commenting, and opining today. Perhaps, before they weigh in on the next public health issue, they should attend an epidemiology course.

[1] Hviid, A., Hansen, J. V., Frisch, M. & Melbye, M. Measles, mumps, rubella vaccination and autism: A nationwide cohort study. *Ann. Intern. Med.* (2019). doi:10.7326/M18-2101