



Poster relating to water fluoridation, c. 1970-1980.

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Fluoridation of drinking water in the UK, c.1962-67

A case study in scientific misinformation before social media

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Executive summary

1. 'Misinformation' is a sociologically and epistemologically blunt term with which to consider the transmission of claims amongst the general public.
 - 1.1. It can be seen as a spectrum of truthfulness.
 - 1.2. Asymmetries of power and knowledge must be taken into account; misinformation can be understood as a tactical attempt to 'argue'
 - 1.2.1. when there is scope for disputing the completeness and relevance of scientific findings;
 - 1.2.2. when true information is presented in a form and manner that is indistinguishable from misinformation;
 - 1.2.3. when no platform for direct engagement with scientific authorities/governors is available.
2. Debates about the safety of sodium fluoride in water peaked in Britain between 1962 and 1967, when local authorities were tasked by central government with deciding whether or not to fluoridate their water supplies.
3. There is evidence to suggest that both sides in the debate were regarded as excessively exercised by the silent majority of citizens. Nevertheless, vocal anti-fluoridators carried the day in terms of policy.
4. A relatively small number of gatekeepers injected the mis/information into the public domain that fuelled the debate.
5. Mis/information about sodium fluoride circulated via long pamphlets; short flyers; local newspaper articles, editorials and letters; TV and national media; public and private meetings; and rumour.
 - 5.1. The more local and/or private the forum, the more incendiary the mis/information tended to be.
6. Mis/information about sodium fluoride took two main forms. Both were often backed with references to research, with varying levels of plausibility:
 - 6.1. Claims about medical effects.
 - 6.2. Claims about 'expert' knowledge:
 - 6.2.1. concerning an alleged lack of expert consensus *per se*;
 - 6.2.2. concerning experts' alleged objections to water fluoridation.
7. There was rhetorical similarity between pro-and anti-fluoridation propaganda which made it difficult for the public to distinguish between them.
8. There was an epistemological advantage to the anti-fluoridation position in that it is easier to point out scope for doubt than to prove complete efficacy and safety.
9. There was a lack of clarity to the pro-fluoridation position in terms of utility of the intervention and in terms of causal pathway.
10. There was no pathway for the legitimate expression of concern owing to the hiatus between dental and medical expertise; between these and expertise within national government; and between these and local authorities, deputed to defend the science without any knowledge-base to do so.

1. Rationale and research

Recent public panics based on scientific misinformation (e.g. the anti-vaxxer movement and 5G conspiracy theories) have been fuelled (indeed, arguably constituted) by social media. Examining an episode of widespread scientific misinformation that occurred before the era of social media provides - if not a controlled historical experiment - a case-study for suggesting which aspects of widespread scientific misinformation are specific to an era of social media, and which can occur irrespective of medium. It can thus inform future engagement within and beyond social media for good public conversations about science.

This case study is based upon the public furore about the fluoridation of drinking water in the UK from the late 1950s to the late 1960s. The research methods have been historical, comprising a review of public expressions of 'scientific' doubts about fluoridation. The majority of sources have been letters to national and local newspapers; news items in local newspapers (more inclined than national titles to report on points made in local meetings); and anti-fluoridation literature produced in the period. Parliamentary discussions have also been reviewed in full. While not strictly quantitative in nature, the research has taken account of what constituted widely-circulated (as opposed to niche) arguments and allegations. The research was affected by the Covid-19 pandemic and was restricted to such sources as were accessible online.¹ Contact was sought with two key parties still in existence, the National Pure Water Association and the British Housewives' League, but neither responded to inquiries.

2. Chronology

In 1945, scientists conducted the first controlled trial of water fluoridation in Grand Rapids, Michigan, to discover whether it would reduce the incidence of dental caries in the population. The first known UK experiment on the dental effects of fluoridation was in 1949; in it, children in a Cheshire orphanage had their teeth painted with fluoride. The following year, a larger trial on fluoride-painting of teeth was carried out in Fife, on 3000 children - this time with family consent.

Evidence for the success of the American trials was accepted by dentists and many politicians (including President Eisenhower) by around 1951, and in June of that year, Anglesey County Council (Wales) first sought permission to fluoridate its water supply. The British government sent a mission to the US and Canada in 1952 to find out more about the results of North American trials; its report was published in 1953.² In 1954, Kilmarnock (Scotland) announced an experiment on water fluoridation that took advantage of its natural 'control' set-up in the form of two reservoirs (one to be fluoridated, the other not). 1954 also saw the first opposition to 'mass medication' expressed in UK parliamentary debate. Between 1954 and 1956, Anglesey, Kilmarnock, Watford (southern England) and Andover (ditto) all began trial fluoridation projects, and local protests ramped up. In response to the strength of public objection, Andover ceased fluoridation in 1958, with Kilmarnock following suit in 1962. The National Pure Water Association (NPWA) was established in 1960 by Lord Douglas of Barloch, the person who had spoken against fluoridation in the Lords in 1954. The NPWA went on to play a substantial role in producing literature objecting to fluoridation, and generally encouraged and supported local campaigners on the topic.

¹ In particular, local archives at the sites of the four trial sites (Anglesey, Kilmarnock, Watford and Andover) could not be accessed. Science-fiction fanzines and women's magazines, which were hoped to yield additional sidelights on the debate, could not be examined in their respective archives.

² Ministry of Health, 'Fluoridation of Domestic Water Supplies in North America as a Means of Controlling Dental Caries: Report of the United Kingdom Mission, Feb-April 1952' (London: HMSO, 1953).

The UK government’s first report on fluoride efficacy in preventing dental caries was published in 1962 and included an appendix on safety, intended to rebut rumours about the dangers of fluoride that had begun circulating through local communities during the late fifties and early sixties.³ The government now invited local authorities to fluoridate their water supplies, triggering local debates around the country. In 1965, of the 145 local authorities in England and Wales which supervised their own health services, 64 were pro-fluoridation, 26 against, and the rest undecided.⁴ By 1967, when the number of local health authorities in England and Wales had grown to 203, the proportions were roughly the same: 110 had decided in favour of fluoridating water supplies, and 73 against.⁵ However, such was the strength of objection that by 1969, Birmingham and Watford were the only local councils to fluoridate their water (albeit in the former case reaching a large urban populace).⁶

The debate continues to the present day, but this report focuses on the heated period of trials and attempted implementation, that is, c. 1962-67, when local newspapers were filled with letters on the topic, pamphlets from the NPWA abounded, and rumours were rife (figure 1).

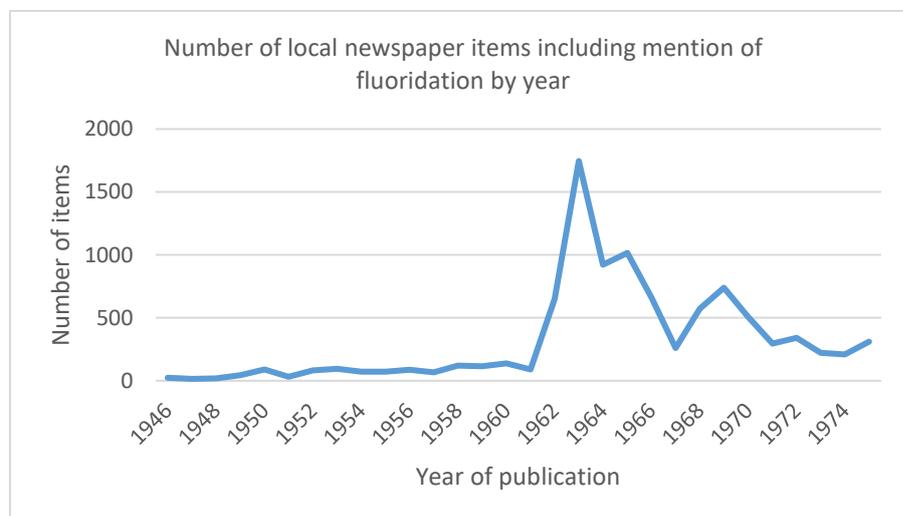


Figure 1: The number of local newspaper items on fluoridation per year gives an indication of the chronology of the controversy. Source: British Newspaper Archive.⁷

³ Ministry of Health, Scottish Office, Ministry of Housing and Local Government, ‘The conduct of the fluoridation studies in the United Kingdom and the results achieved after five years’ (London: HMSO, 1962).

⁴ *Daily Mail*, 11 November 1965.

⁵ Fluoridation: Oral Answers to Questions — Ministry of Health – House of Commons, 4 December 1967. Hansard.

⁶ *The Listener*, 6 March 1969.

⁷ <https://www.britishnewspaperarchive.co.uk/> search performed 9 June 2021. The archive contained over 1000 titles at the time of searching. It excludes national newspapers. Items include articles, opinion columns, editorials, letters, announcements and advertisements (although none of the last item was discovered by human searching). The search includes ‘fluoride’, ‘fluoridation’ and ‘fluoridate’ but does not duplicate those items (i.e. an article containing ‘fluoride’ and ‘fluoridate’ will only count as one hit). These numbers are not absolute since they only include those local titles digitized by the British Newspaper Archive and reflect any anomalies resultant from the digitization and indexing processes.

3. Defining misinformation

Misinformation is information that is incorrect.⁸ In everyday use, the word can also carry the implication that this incorrect knowledge has been conveyed deliberately with an aim to deceive or otherwise to cause mischief.

Both elements of the definition need a little thought, however. The more damning definition - that misinformation is *intended* to mislead - is fluid in reality. Person A may knowingly convey a falsehood to person B, who may then spread it in good faith. A piece of misinformation has become merely an incorrect piece of information. Even the apparently more innocuous definition, incorrect information, is a slippery term. Scholars in Science and Technology Studies (STS) have for many years drawn attention to the situatedness of knowledge.⁹ A scientific or quasi-scientific claim does not, in practice, stand alone as a testable and provable assertion, but takes its place in an ecosystem of experience, knowledge, belief and value. What looks like a piece of misinformation can be understood functionally as a *crie de coeur*: a plea to be listened to, or to be consulted. It can also reflect, but be poorly articulated as, a legitimate doubt about science or its application. For these reasons, 'mis/information' is frequently used throughout this report, to indicate the grey scale between true and false, good-faith and bad-faith assertions. What is a pathway for misinformation is also a pathway for good information.

Ordinary Britons had considerable folk experience of sodium fluoride (the form added to water) by the time it was proposed as a water additive. Sodium fluoride was well-known as a universal insecticide and household poison, used throughout the first half of the twentieth century against all kinds of vermin, including rats (this is significant because rats are mammalian; what poisons a rat is widely understood also to poison humans).¹⁰ Moreover, there had been nationally-circulated news stories about livestock fluoride poisoning in Scotland in the late 1940s (awareness of which spread with its whistle-blower to Bristol in 1948/9).¹¹ Fluoride was also known (as in the livestock poisoning incident) as a waste-product of the expanding aluminium industry. To ordinary people, it flew in the face of everyday experience to add this 'poison' to their water. Doctors, dentists and politicians - in those days unlikely to get involved in domestic chores - may have been unaware of the associations of their proposed additive in the minds of the general populace.

As well as this folk knowledge of fluoride as poison, fluoride had been in the news. Those with a particular interest in science might have seen coverage of fluoride's potential in chemical weaponry, and particularly as an enzyme inhibitor.¹² But the biggest news story concerning fluoride was the unmasking of the Piltdown fraud in 1949-1950. Thanks to the role of fluorides in revealing the hoax skull's true age, readers of *The Times* (London) and BBC magazine *The Listener* - to give just two examples - knew that fluorides accumulate in human bones over a lifetime.¹³ Therefore the routine

⁸ The OED's relevant sense (definition 2) is 'wrong or misleading information'.

⁹ A sample of this vast literature includes: Brian Wynne, 'Misunderstood Misunderstanding: Social Identities and Public Uptake of Science', *Public Understanding of Science* 1 (1992): 281-304; Frank Fischer, *Citizens, Experts, and the Environment: The Politics of Local Knowledge* (Durham, NC: Duke University Press, 2000); Alan Irwin and Brian Wynne, eds., *Misunderstanding science? The Public Reconstruction of Science and Technology* (Cambridge: Cambridge University Press, 2003).

¹⁰ 'Editorial.' *Nottingham Evening Post* 23 February 1940, p. 5. British Library Newspapers, link-gale-com.chain.kent.ac.uk/apps/doc/JE3238375294/GDCS?u=uokent&sid=GDCS&xid=7d145415. Accessed 11 March 2021.

¹¹ 'Veterinary Science in Bristol: Prof. F. Blakemore', *Nature* 162 (1948), 327. <https://doi.org/10.1038/162327c0> Accessed 11 March 2021.

¹² *The Listener* 38 (971), 4 September 1947.

¹³ *The Times*, 6 September 1949; *The Listener* 43 (1108), 20 April 1950 and 44 (1121), 20 July 1950.

claims that one would have to drink ‘two and a half bathfuls’ of fluoridated water to experience any ill effects did little to reassure; over the course of a lifetime, such a volume would easily be consumed.¹⁴

Although some of the more outlandish claims made about fluoridation are scientifically untenable, it is not appropriate or productive to approach them as testable hypotheses whose disproof ought to have reassured the public. Rather, they may be better treated as an expression of doubt, perhaps rooted in ‘common-sense’ knowledge or reasoning, or a protest at being ignored.¹⁵ In a similar vein, there has been a great deal of research about the efficacy of engaging climate skeptics not on an empirical level, but on a psychological and emotional one.¹⁶ One particular source of scepticism about the consumption of unfamiliar prophylactics was the thalidomide scandal, which broke in 1961-2 – just as local authorities were invited to implement fluoridation of water supplies.¹⁷ From about 1966, the content of anti-fluoridation letters to local newspapers shifted subtly away from an emphasis on ‘scientific’ arguments to a simple protest at lack of democratic process/fear of authoritarianism. That concern had always been present in earlier anti-fluoride literature, but appears to have crystallised as the base issue by the late ‘60s.

4. What mis/information was spread concerning fluoridation?

Although there was some early coverage of fluoridation around the time that the first four trial sites were selected in the UK, the low numbers of items from local newspapers (figure 1) indicate that the topic did not loom very large in the public mind.¹⁸ It was after the cessation of two of the trials that the NPWA was founded (1960) and began to coordinate and fund the composition and distribution of reams and reams of literature. The production of these leaflets was dependent upon a network of relatively wealthy people who had the finances and the confidence to research, write and print. They drew ammunition from already established campaigns against fluoridation in the US and Australia.¹⁹ The compilation of international facts and fictions assembled by the NPWA in a short space of time was a remarkable achievement for those outside of research circles.

The flow of specialist information from overseas came through a bottleneck of a few people and spread to an enormous number, thanks to NPWA publications ranging from single-page flyers to booklets running to dozens of pages in length.²⁰ Jokes about being pounced upon with leaflets in town centres and outside meetings were widespread. Local councillors were sent them by the

¹⁴ Ministry of Health, ‘Fluoridation’ (London: HMSO, 1965); National Pure Water Association, *Fluoride Facts and Fancy: An Examination of How Official and Other Bodies Promote Fluoridation of Public Water Supplies by the Suppression of Adverse Facts and Research, by Misleading Statements and by Exaggerated Claims* (NPWA, Reprint October 1965 [first published November 1964 and reprinted March 1965]), p. 12.

¹⁵ For a critical review of the sociology of fluoridation in Australia, see Brian Martin, ‘Analyzing the Fluoridation Controversy: Resources and Structures’, *Social Studies of Science* 18.2 (1988): 331–363; Brian Martin, ‘The Sociology of the Fluoridation Controversy: A Reexamination’, *The Sociological Quarterly* 30.1 (1989): 59–76.

¹⁶ Sabine Roeser, ‘Risk Communication, Public Engagement, and Climate Change: A Role for Emotions’, *Risk Analysis: An International Journal* 32.6 (2012): 1033-1040.

¹⁷ Letters to the editor, *Buckinghamshire Examiner*, 26 April 1963, <https://www.britishnewspaperarchive.co.uk/viewer/bl/0002490/19630426/188/0014> accessed 12 June 2021.

¹⁸ The magazine *Picture Post* was an early opponent of fluoridation; the major article ‘Hands off Our Drinking Water!’ (5 March 1955) described fluoride as ‘the hellcat of the elements’.

¹⁹ One major source of information was Philip Sutton, *Fluoridation: Errors and Omissions in Experimental Trials* (2nd, enlarged edition), (Melbourne: Melbourne University Press, 1960 [1959]). As the additions to the second edition make clear, this had also been circulating in the US, much to the annoyance of pro-fluoridation researchers.

²⁰ Gerald Hinks, ‘Pen and Hinks’, *East Kent Gazette*, 29 March 1963, <https://www.britishnewspaperarchive.co.uk/viewer/bl/0002521/19630329/113/0006> accessed 12 June 2021.

bagful.²¹ Anti-fluoridation newspaper correspondents often mentioned having at their disposal facts, information and statements from various medical bodies which were embedded in these leaflets.

Only the more substantial publications have been conserved for the historic record, and the content of the cheaper, briefer and more ephemeral kind must be inferred. One example that allows us to make such an inference concerns trisomy 21. Data from the British Newspaper Archive shows that letters to local newspapers linking fluoridation and trisomy 21 peaked in 1964, the year in which a major NPWA booklet made the connection (figure 2).²²

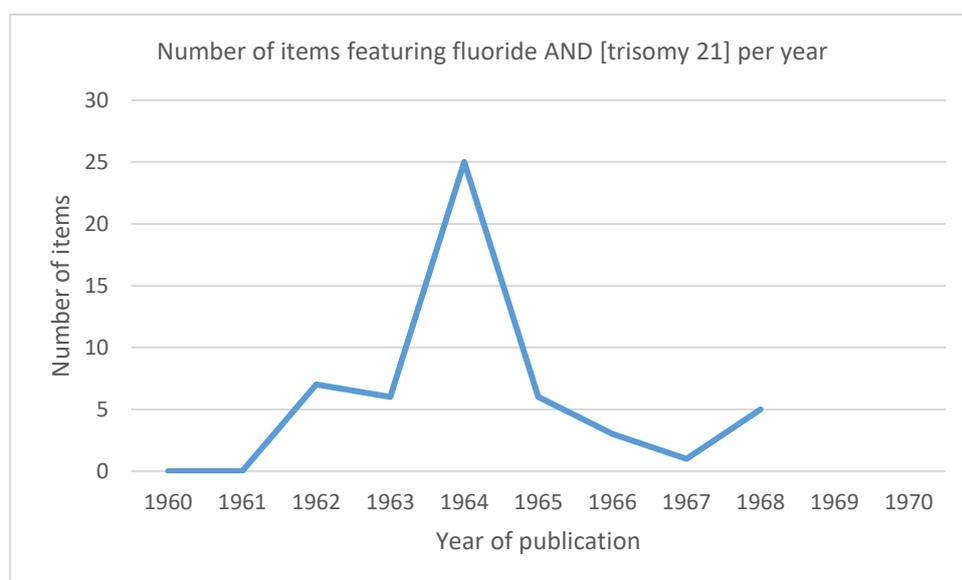


Figure 2: Number of local newspaper items mentioning both fluoride and trisomy 21 by year of publication. Source: British Newspaper Archive.²³

However, the NPWA pamphlet was not published until November of that year, whilst the bulk of letters were earlier on, peaking in the summer. It can be concluded that the longer NPWA leaflet was the successor to a number of much shorter and possibly more alarmist leaflets that had already been in circulation for some time.

²¹ 'Chesham Waits', *Buckinghamshire Examiner*, 2 August 1963

<https://www.britishnewspaperarchive.co.uk/viewer/bl/0002490/19630802/014/0002> accessed 12 June 2021.

²² National Pure Water Association, *Fluoride Facts and Fancy: An Examination of How Official and Other Bodies Promote Fluoridation of Public Water Supplies by the Suppression of Adverse Facts and Research, by Misleading Statements and by Exaggerated Claims* (NPWA, Reprint October 1965 [first published November 1964 and reprinted March 1965]), p. 22-4. C. Blakemore and S. Jennett, (2001), 'Thalidomide', in *The Oxford Companion to the Body* (Oxford: Oxford University Press, 2021). Retrieved 7 June 2021, from <https://www.oxfordreference.com/view/10.1093/acref/9780198524038.001.0001/acref-9780198524038-e-943>.

²³ <https://www.britishnewspaperarchive.co.uk/> search performed 9 June 2021. The archive contained over 1000 titles at the time of searching. It excludes national newspapers. Items include articles, opinion columns, editorials, letters, announcements and advertisements (although none of the last item was discovered by human searching). These numbers are not absolute since they only include those local titles digitized by the British Newspaper Archive and reflect any anomalies resultant from the digitization and indexing processes. Trisomy 21 was routinely referred to using a racialized term during the 1960s, which was used for the purposes of searching. See David Wright, *Downs: The History of a Disability* (Oxford: Oxford University Press, 2011), pp. 9–10.

It is economic common sense that most people attending a town hall event (or minding their own business in the high street) would have received one of the slighter leaflets rather than one of the longer, denser, more closely argued booklets. Analysing one rare example shows that a short leaflet was constructed very differently to the big pamphlets that have been archived. 'Fluoridation in Andover, Hampshire' amounts to just a couple of sides of text; the first thing to note about it is that a national organisation (the NPWA) has funded an entirely locally-focused leaflet.²⁴ It is also, unlike the substantial pamphlets, entirely anecdotal in its construction. The leaflet starts by describing illnesses attributed to the fluoridation of Andover's water supply, and details the digging of a well by one of the town's residents to avoid 'poisoning' by the municipal water supply. This John Snow-style story in turn gives rise to a number of anecdotal proofs whereby ill persons switch to the well water and are relieved of their symptoms.²⁵ It is an entirely localised, anecdotal account that works on the basis that people tend to trust their near neighbours' accounts over those of unknown authorities.

Further to leaflets, mis/information about fluoride was spread through meetings (advertised in local newspapers), many of them conducted under the auspices of pre-existing women's groups. At least one film was in circulation, too (figure 3).

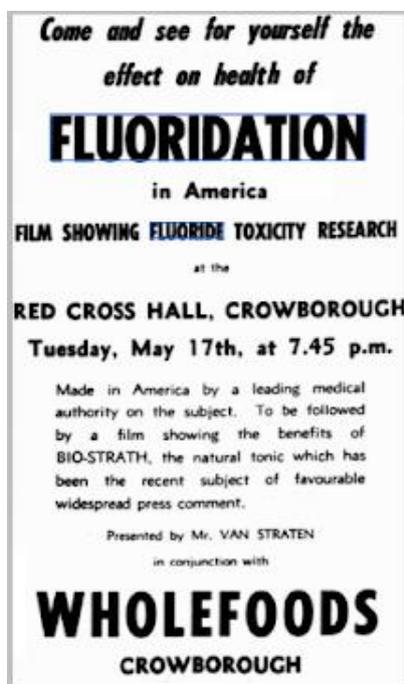


Figure 3: Anti-fluoridation film advertised in *Kent & Sussex Courier*, 13 May 1966.²⁶

The film's sponsorship by a health product company indicates another source of the spread of mis/information – those with something to sell. The humorous magazine *Punch* claimed that noted

²⁴ The leaflet has been recreated on the NPWA's website: http://www.npwa.org.uk/wp-content/uploads/2008/06/f_andover.pdf (accessed 15 June 2021). Only in the final paragraph is reference made to research conducted elsewhere, one that names the scientists concerned, the other referring anonymously to research carried out in Spain. A publication by the named scientists can be traced and its content broadly matches its rhetorical deployment: Reuben Feltman and George Kosel, 'Prenatal Ingestion of Fluorides and their Transfer to the Fetus', *Science* (Washington) 122 (1955): 560-561.

²⁵ According to the simplified history, John Snow successfully identified a particular London street pump as the source of a cholera epidemic and, by cutting it off, stopped the disease.

²⁶ <https://www.britishnewspaperarchive.co.uk/viewer/bl/0000483/19660513/642/0010>. Accessed 12 June 2021.

romantic novelist and society figure Barbara Cartland combined her public objection to fluoridation with a canny line in unfluoridated water at tenpence a pint.²⁷ Finally in this list of pathways of mis/information, and hardest to trace in the historical record, comes simple rumour. David Borrett’s account of the fluoride years in Andover gives a sense of this feverish culture, focused upon a particular school.²⁸

What was the overall tenor of this mis/information? In the US, fluoridation was routinely associated with communist plots.²⁹ Although concern was expressed in the UK about the authoritarian nature of ‘mass medication’, fluoridation itself was not associated with any particular political framework and cut across party lines in terms of support and rejection.³⁰ British anti-fluoridation literature did contain occasional references to Nazism and fascism, particularly in earlier years, but only as suggestive comparisons, not as directly attributed motivations amongst the fluoridators. The British release of the film *Dr Strangelove* in 1964 may have helped to scotch political conspiracy theories concerning fluoridation; Jack D. Ripper’s claim that ‘fluoridation is the most monstrously conceived and dangerous communist plot we have ever had to face’ confirmed, for those who had not swallowed conspiracy theories already, that only the unhinged took such arguments seriously.³¹

Cartoons through the period cast both pro- and anti-fluoridators as extremists. There was a general sense that though British teeth would most likely be improved through fluoridation, there was something rather sententious and even un-British about promoting it. The humorous magazine *Punch* featured a column by a comic doctor character who ‘list[ed] his hobbies as watching BBC-2 and drinking fluoridated water’.³² No clearer indicator of tiresome worthiness could be dreamt up. At the other end of the scale, a correspondent of the *British Medical Journal* consoled readers with the thought that ‘dental excellence is pre-eminently the attribute of the [racialized term] and the American’.³³ Fluoridation might work but it was not very [white] British to get worked up about it one way or the other.

4.1 Medical mis/information

Instead of making political insinuations, British misinformation focused on medical and medical-related claims. A comparison of two key pamphlets (figure 4) indicates how different claims rose and fell in visibility. These are substantial publications; Gaudin’s *Fluoridation Fallacy* (1961) runs to 54 pages, and the National Pure Water Alliance’s *Fluoride Facts and Fancy* (1964) is 35 pages long.

R. F. Boyd Gaudin, <i>The Fluoridation Fallacy</i> (September 1961)	NPWA, <i>Fluoride Facts and Fancy</i> (November 1964)
Cumulative poison	Cumulative poison
Heart and blood vessel disease	Calcification of blood vessels
Arthritis	
Increased bone density	Bone thickening/skeletal fluorosis (implied to be associated with difficulty in breathing)

²⁷ *Punch*, 1 September 1965.

²⁸ David J. Borrett, *Something in the Water: The Anti-Fluoride Campaign in Andover 1955-1958* (Andover History and Archaeology Society, 2002).

²⁹ R. Allan Freeze and Jay H. Lehr, *The Fluoride Wars: How a Modest Public Health Measure Became America’s Longest-Running Political Melodrama* (Hoboken, New Jersey: Wiley, 2009).

³⁰ The Conservative Enoch Powell, Minister for Health 1960-63, was one of its greatest advocates.

³¹ The fluoridation claim was highlighted in many newspaper reviews of the film. Jokes about American conspiracy theories and fluorides also appeared in *Punch* (8 June 1960) and *The Listener* (4 October 1962).

³² *Punch*, 13 January 1965.

³³ Correspondence: Fluoridation of Water, *British Medical Journal* 1955; 1:418. doi: <https://doi.org/10.1136/bmj.1.4910.418-c> (Published 12 February 1955, accessed 14 June 2021).

R. F. Boyd Gaudin, <i>The Fluoridation Fallacy</i> (September 1961), cont.	NPWA, <i>Fluoride Facts and Fancy</i> (November 1964), cont.
Osteosclerosis	Bone calcification/back problems/spine damage
Cataracts	
Hearing defects	
Sickness/stomach problems	
Haemorrhage	
Bladder/urinary tract disorder	(See below: kidney damage)
Frangible/over-hard teeth	Frangible/over-hard teeth
	Serious mottling
	Jaw development adversely affected
	Kidney damage
	Pneumonia (see bone thickening)
	Goitre
	Infantile bone dystrophy
	[Trisomy 21]
	Enzyme inhibition
	Cell damage (implied connection to cancer)
	Plants metabolise it to create poison fluoroacetate

Figure 4: Medical side-effects of fluoride mentioned in anti-fluoride pamphlets of 1961 and 1964.

Between them, these two pamphlets cover most of the alleged effects mentioned elsewhere. A few others appear in parliamentary debate and newspaper accounts and letters: allergy, listlessness, periodontal disease, rashes, suppression of lactation. Others are non-specific, or could be accounted for as variants of effects listed in figure 4. ‘Progressive wasting’, for example, is a description of fluoride as a cumulative poison. Other effects mentioned elsewhere include danger to livestock, killing goldfish, and spoiling the taste of whisky.³⁴

Anti-fluoridation pamphlets give some idea of trends in claims that came, went or developed through the 1960s. The key claim of fluoride as ‘cumulative poison’ proved to be a persistent claim, present in both pamphlets and lasting through the 1960s. It benefited from being a somewhat vague designation that gave scope for a variety of symptoms and hinted symptoms to be described and imagined. The repeated protestations of governors, doctors and others regarding the relative quantities of safety and non-safety kept the anxiety alive, especially because they insisted on quoting figures for acute poisoning but rarely if ever addressed the question of chronic poisoning (except by reasserting that many areas have natural fluorides present in the water, which did not strike the objectors as a valid argument). A second retained category of side-effect was centred on pathological hardening and thickening of teeth and bones. This was intuitively connected to the intentional effects of fluoride and had developed by the time of the NPWA pamphlet to include jaw malformation and more detail on skeletal damage. Some misinformed claims faded away: haemorrhage, cataract and hearing damage, for example. New ones appeared to take their place; of these, the most significant was the alleged causation of trisomy 21 in the unborn.³⁵ The research on

³⁴ In 1958, the BBC programme *Panorama* specifically noted that Watford possessed a ‘fluoridated lake full of gold fish’, suggesting that the myth was already in circulation by the late 1950s. *Panorama* No. 120 Edited and produced by Rex Mountfoot, directed by Nancy Thomas. Transmission: Monday 9 June 1958. Script from BBC archives.

³⁵ National Pure Water Association, *Fluoride Facts and Fancy: An Examination of How Official and Other Bodies Promote Fluoridation of Public Water Supplies by the Suppression of Adverse Facts and Research, by Misleading Statements and by Exaggerated Claims* (NPWA, Reprint October 1965 [first published November 1964 and reprinted March 1965]), p. 22-4.

which this connection was claimed was published in 1957, but came to the fore in anti-fluoridation literature after the breaking of another prenatal health news story – thalidomide (1961-2). The British Newspaper Archives gives no news items linking trisomy 21 and fluoride from 1957-61; 6 and 7 items linking them in 1962 and 1963 respectively; and in the year of the NPWA pamphlet’s publication (1964), 25. By 1964, all that remained for *Fluoride Facts and Fancy* was to demolish the somewhat disingenuous critique of the research that had been provided by the Ministry of Health.³⁶

Cancer is a notable absence from both of the major pamphlets described here, though it was mentioned in many letters to local newspapers. The reason for this would seem to be that there was an absence of research references to back up the association; every item listed in figure 4 has a reference (however tendentious) to bolster it. An absence of references – as was the case for cancer – was a step too far for these longer and quasi-academic anti-fluoride publications. Still, it was not in the anti-fluoridationists’ interest to correct newspaper correspondents or locally-produced flyers if they made that connection (which they did).

The changing list of alleged side-effects between 1961 and 1964 (and the presence of other allegations in other sources) meant that misinformation was a moving target throughout the 1960s. No sooner was one fear addressed then another popped up – with the process repeating at different times in different communities. Opponents of fluoridation further exploited the fact that the positive claims of fluoridationists were somewhat mutable themselves, and lacked either a defined purpose (precise targeting of populations and quantified targets) or a clear causal basis that could be explained and defended. Pamphlets, flyers and letters highlighted the fact that some results implied that dental disease was perhaps delayed rather than prevented; and certainly reduced rather than removed – leaving open the possibility of other, more effective interventions such as the improvement of diet or dental hygiene.³⁷ The unknown causal pathway of fluorides led to a news bubble in 1964 when the *Express* newspaper reported that molybdenum might, in fact, prove to be the crucial factor in reducing decay.³⁸

4.2 Mis/information in description of authority

A second category of misinformation (besides alleged medical side-effects) was the misrepresentation of medical and scientific opinion. Using scientific experts as vicarious critics was a key method for the anti-fluoridators. The most influential source in this regard was Philip Sutton’s book, *Fluoridation: Errors and Omissions in Experimental Trials* (1959).³⁹ Its subtle points were recycled again and again in the many anti-fluoridation pamphlets citing critiques of method, statistics and reporting in fluoridation experiments. Some of the research cited as demonstrating medical side-effects was misrepresented, or perhaps misunderstood. A much mocked example came in Gaudin’s pamphlet, which described the haemorrhagic death of numerous turkeys in fluoridated Andover. Gaudin attributed these deaths to the power of fluorine ‘to precipitate the soluble lime in the blood, the absence of which prevents blood from coagulating’. A rather tortuous trail of references eventually conducted the reader to an unnamed veterinary surgeon in a private

³⁶ The exact published source of this critique is unclear, but broadly matches that in a letter sent by Senior Medical Officer Edmund Martin at the Ministry of Health to Dr S. Ludkin, County Medical Officer, Durham, on 5 February 1965. Wellcome Archive, PP/CPB/A.8/11.

³⁷ Debate in parliament, in particular, questioned why money was proposed to be spent on fluoridation instead of improving dental care.

³⁸ *The Express*, 30 July 1964.

³⁹ Philip Sutton, *Fluoridation: Errors and Omissions in Experimental Trials* (2nd, enlarged edition), (Melbourne: Melbourne University Press, 1960 [1959]).

letter to the author.⁴⁰ At the other end of the plausibility scale, the trisomy 21 claim was based on a fair representation of the underlying research, a paper which moreover asserted a causal pathway for the effect that chimed with known facts about fluoride.⁴¹ Between these two extremes lay a whole spectrum of uses of published research. It would take too long to unpack them all, but they range from good-faith references, to somewhat tenuous connections, all the way to completely unwarranted interpretation. Asking whether or not the authors were deliberate in their tendentious interpretations is not particularly helpful; once they were in the public domain, they all circulated on an equal basis.

The overwhelming effect of anti-fluoridation leaflets – particularly the longer ones – was a tidal wave of names, institutions and references to published research. Some of these were studies used by the pro-fluoridationists, patiently unpicked, and others were studies supposedly supportive of the anti-fluoridation stance. Even as an experienced researcher and science communicator, with the internet at my fingertips, the author of this report will confess to feeling swamped at times by the sheer volume of purported information. It is not too great a leap of imagination to say that the 1960s recipient of propaganda was often steam-rolled into accepting that the cumulative voice of science was against fluoridation.

In many cases, names of scientists opposing water fluoridation were simply listed without their research (or rather because they had published no research on the topic). Philip Sutton's book, *Fluoridation* (1959) was mocked by one of its critics for its mention of 'eminent authorities' – seemingly already a standard term for anti-fluoridationists in the US by then. Sutton retaliated in the second edition (1960) by naming them and defending their status.⁴² In Britain, the London Anti-Fluoridation Campaign published a two-part pamphlet listing 'international authorities' (including Nobel prize winners) supposedly opposed to water fluoridation.⁴³ Copies for distribution could be ordered at the price of 10 shillings per hundred copies (about £8 in 2021 prices). Other pamphlets recycled these lists of names, and cited named objectors (with their research, where appropriate). Distributed at anti-fluoridation meetings, it is tempting to imagine that many recipients were naïve enough to be impressed at the list of doctors, professors and universities. This was certainly the impression given by the *vox pop* selected by the BBC for broadcast in their *Panorama* news magazine feature on fluoridation in 1958. The unnamed woman explained:

It's definitely harmful to elderly people [...] I do think that anything that is chemical damages the bloodstream, and causes a toxic condition. It must do. [...] I've been told that with the older person, over fifty, it has a tendency to [...] harden the arteries, and then again, it can cause a ... [sic] effect in children, and I have seen some medical data from America, and well, it's pretty ghastly some of it.⁴⁴

⁴⁰ R. F. Boyd Gaudin, *The Fluoridation Fallacy: A Commentary on Official Statements Which support the Fluoridation of Public Water Supplies* (Rochford, Essex: privately published, 1961). Section: 4 (iii) reports of injury to health.

⁴¹ Ionel Rapaport, 'Contribution à l'étude étiologique du mongolisme. Role des inhibiteurs enzymatiques', *Annali di Neuropsichiatria e Psicoanalisi* 4.1 (1957): 13-20.

⁴² Philip Sutton, *Fluoridation: Errors and Omissions in Experimental Trials* (2nd, enlarged edition), (Melbourne: Melbourne University Press, 1960 [1959]), p. 124.

⁴³ London Anti-Fluoridation Campaign, 'Authorities Question Fluoridation' (pamphlet in two parts), second edition, no date, Wellcome Archive, PP/CPB/A.8/11.

⁴⁴ *Panorama* No. 120 Edited and produced by Rex Mountfoot, directed by Nancy Thomas. Transmission: Monday 9 June 1958. Script from BBC archives.

Sociologists Harry Collins and Robert Evans suggest a different way of looking at this apparent naivety. It is not possible for a non-specialist to assemble a full understanding of the content of a given science, and so they must rely on meta-skills of social discrimination to judge claims on the basis of those who make them – their degree of trustworthiness. Collins and Evans distinguish between ubiquitous and local discrimination; the latter is particularly important in the case of fluoridation as a local gatekeepers funnelled mis/information from national sources.⁴⁵ A trustworthy local figure (in turn, perhaps, relying on their own meta-expertise) could validate mis/information for a wide circle of people. Still another other way of looking at this apparent naivety would be that anti-fluoridationists who asserted faith in the lists were simply playing the same game as the people who compiled them. Whatever the best way of explaining the ubiquitous references to ‘eminent authorities’, it would have been extraordinarily difficult to have the time and resources to find out who these people were or to verify their credentials and perspectives. The effect of the lists was again, perhaps, one of steam-rolling. Moreover, it is hard to imagine why these leaflets were reprinted unless their effect was felt to be positive to the cause.

Besides citing scientists (with or without their research) who allegedly upheld the anti-fluoridation position, the highlighting of disagreement within science *per se* was another key tactic. This tactic could be construed to exploit an unrealistic assumption that good science is always agreed upon by all parties. Anti-fluoridation literature also highlighted the expertise gap between those who recommended fluoridation (dentists) and those who might reasonably be expected to know about the side-effects of fluoride upon the human body (doctors and physiologists).⁴⁶ There was something in this line of argument. Although doctors tended to align with dentists in advocating fluoridation, it would be difficult to say that all were assenting to the same scientific consensus. The first conscious attempt at creating such a consensus occurred in 1959, when the American Association for the Advancement of Science gathered a series of ten papers on the pharmacological and toxicological effects of fluorides.⁴⁷ However, most gatherings of research towards the question of safety were conducted not by scientists but by legal and governmental entities around the world, including in the UK, where the Ministry of Health did so.⁴⁸ Moreover, the pieces of published research scrutinised by these committees were dispersed through dental, medical, industrial and general scientific journals. They did not constitute a paradigmatic body of research, and it is unlikely that many doctors would be *au fait* with such a scattered array of findings. It might be reasonable to say that any scientific ‘consensus’ was as much a tribal agreement as anything else, based upon acceptance of the value of fluoridation for dental health and a sense of shared social authority between medicine, dentistry and science. Besides this gap between dentistry and medicine,

⁴⁵ Harry Collins and Robert Evans, *Rethinking Expertise* (Chicago: University of Chicago Press, 2008); Matthew Thomas and Luke Buckmaster, *Expertise and Public Policy: A Conceptual Guide*, Parliamentary Library [Australia], 2013.

https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1314/PublicPolicy. Accessed 16 June 2021

⁴⁶ ‘Mass Medication Not Progress’, *West Sussex County Times* 26 September 1958

<https://www.britishnewspaperarchive.co.uk/viewer/BL/0001925/19580926/139/0008> accessed 12 June 2021.

⁴⁷ Joseph C. Muhler and Maynard K. Hine, eds, *Fluorine and Dental Health: The Pharmacology and Toxicology of Fluorine* (Bloomington: Indiana University Press, 1959). The collection was republished in the UK in 1960. Two previous symposia had investigated the efficacy of fluoridation, but this was the first to examine possible side-effects.

⁴⁸ Department of Health and Social Security, Scottish Office, Welsh Office, Ministry of Housing and Local Government Reports on Public Health and Medical Subjects, ‘The Fluoridation Studies in the United Kingdom and the Results Achieved after Eleven Years’ (London: HMSO, 1969), p. 3. The results were published in an appendix to Ministry of Health, Scottish Office, Ministry of Housing and Local Government, ‘The conduct of the fluoridation studies in the United Kingdom and the results achieved after five years’ (London: HMSO, 1962).

correspondents of local newspapers also highlighted the mechanical and human vagaries of water treatment, and the varieties of human behaviour in regard to water consumption, each of which had its own body of expertise not referred to by the dentists and their allies.

A final category of misinformation about authorities concerned those places where fluoridation had been tried and subsequently discontinued (or not tried at all). Discontinuation played strongly as an argument for many newspaper correspondents.⁴⁹ The fact that the US, ahead of the UK in its trials, had discontinued many fluoridation projects suggested that there was a trajectory to the science of optimism-implementation-disenchantment from which Britain would do well to learn. Moreover, other European countries were cited as having decided against fluoridation. The implication of the propaganda was: what did they know that Britain did not? The facts of discontinuation and rejection were true, even if the trajectory of the information was not.

5. Pathways for mis/information

Pathways for the transmission of mis/information include people, and their motivations and behaviour, as well as the intrinsic plausibility of the mis/information itself. In this historic example, there were some people who were at the top of the chain, producing misinformation, and others and the bottom who were consuming it. In between lay those who were introduced to the claims of organisations such as the NPWA and in turn developed and transmitted them to others, thus acting as both consumer and producer. Local newspapers show evidence of local branches of the NPWA being set up, and these produced their own literature to distribute locally. Information and misinformation in anti-fluoride literature succeeded on the basis of its appeal to particular constituencies, and according to its epistemological (basis of knowledge) and rhetorical form.

5.1 People and motivations in mis/information pathways

It is always difficult to attribute psychological conditions to historical actors, but one can make some educated guesses about the motivations of spreaders of mis/information, or at least describe their types. Some of the earliest objectors to water fluoridation were journalists. Fyfe Robertson, author of 'Hands off Our Drinking Water!' (*Picture Post*, 5 March 1955) was a medically-trained and respected journalist in the investigative tradition of George Orwell, on the look-out for stories where ordinary people had been – or might be – let down by the authorities. Possibly Robertson's Scottish identity played into an instinct that people far from London were particularly in need of a voice that spoke from a default position of scepticism when it came to their governance. Lord Douglas of Barloch, founder of the NPWA, was another early, left-wing critic of the policy. A Canadian émigré to Scotland, he shared with Robertson a humble background and a journalistic profession, afterwards moving through active Labour politics to colonial governance. Given their shared features of biography, one might reasonably attribute some overlap in motivation.

As the anti-fluoride movement gathered pace, establishment figures came to join it whose motivation was perhaps more of a visceral reaction against modernity. Britain was at the time constructing a novel, post-war culture whereby governance was broadly meritocratic and social-

⁴⁹ On 19 September 1963 the *East Kent Gazette* published a letter from a former East Kent Resident who had emigrated to New Zealand, writing to say that fluoridation was being challenged in court and inviting correspondence. <https://www.britishnewspaperarchive.co.uk/viewer/bl/0002521/19630919/096/0006> accessed 12 June 2021. Another representative letter cites over 100 US communities now withdrawn from Fluoridation schemes: *Kent & Sussex Courier* 6 December 1963. <https://www.britishnewspaperarchive.co.uk/viewer/bl/0000483/19631206/086/0005> accessed 12 June 2021.

democratic in nature.⁵⁰ There was a cadre of persons within the anti-fluoridation movement, particularly at the top end, but by no means only there, who felt somehow entitled but excluded from the new mood of governance. Prominent NPWA members very often had titles of civic recognition, whether wartime military titles or titles from the British honours system. It was as though they felt personally insulted by the fluoridation of drinking water, dreamt up by some bumptious clerk or boffin. References to Nazism in anti-fluoridation literature spoke, by antithesis, to strongly-held values of paternalistically upheld freedom, under threat from technocratic meddling. This sense of exclusion cut across party lines. In 1965, of the 26 MPs who wrote to the London *Times* to register their concern about fluoridation, 12 were Conservative and 14 Labour.

Women were also notably prominent within the anti-fluoride movement. They tended not to write the major booklets (in para-science, as in real science, men dominated). However, they did succeed in acting as celebrity figureheads for the movement, where men did not. One notable name in this regard was Barbara Cartland; another was the nutritionist, author and campaigner Doris Grant.⁵¹ Mrs Joyce Mew, chairman [sic] of the British Housewives' League was also an early activist on the issue.⁵² Through her, the League's members became aware of the cause. Women were highly visible in newspaper correspondence opposing fluoridation and in other newspaper items such as organisation of meetings. A notable number of these women – as visible in local newspapers – seem to have been wives of clergy, and their culturally conservative motivation may well align with those male establishment pillars who felt their paternalist authority was under threat. However, other female campaigners were characterised by the fiery investigative spirit of Fyfe Robertson. Unlike Fyfe, who saw himself as reporting by and for others, these women campaigned by and on behalf of themselves. Grant had previously campaigned against use of the agene process in Britain, a method of bleaching flour with nitrogen trichloride had been banned in the US in 1949 over safety concerns. Having been vindicated by contemporary science on this topic, Grant's risk-averse response to fluoridation seemed like a reasonable position for many women. One wonders whether, if Grant had been given more recognition by the medical establishment for her perspective on agenisation, her perspective on fluoride might not have had the particular power it derived from its status as underground knowledge. A number of women's (and some men's) letters to local newspapers moreover make reference to the fact that water is an essential element of life, a necessity for all households. The fact that fluoridation plans struck so 'close to home' made it all the more emotive and, arguably, a topic of special concern for women who conceived of themselves as guardians of the domestic sphere. The health of the foetus, the risk of trisomy 21 and the spectre of thalidomide all loom large in women's newspaper correspondence during the peak period of 1962-7.⁵³ Again, a more public acknowledgement of the medical establishment's failings vis-à-vis thalidomide might have changed the terms of the fluoride debate.

⁵⁰ Dennis Kavanagh. 'The Postwar Consensus', *Twentieth Century British History* 3.2 (1992): 175-190; see also Guy Ortolano, *The Two Cultures Controversy: Science, Literature and Cultural Politics in Postwar Britain* (Cambridge: Cambridge University Press, 2009).

⁵¹ *Taunton Courier and Western Advertiser* 24 May 1958; <https://minervascientifica.co.uk/doris-grant/> accessed 14 June 2021.

⁵² *Kent & Sussex Courier*, 28 August 1953, <https://www.britishnewspaperarchive.co.uk/viewer/bl/0000483/19530828/002/0001> accessed 12 June 2021.

⁵³ 'Mainly for Women', *East Kent Times and Mail*, 17 September 1965 <https://www.britishnewspaperarchive.co.uk/viewer/bl/0003350/19650917/153/0011> accessed 12 June 2021.

5.2 Epistemological and rhetorical features of literature in mis/information pathways

An important epistemological (basis of knowledge) principle underpinned both the citing of medical evidence and division within the ranks of science. Anti-fluoridation leaflets and speakers exploited the difference between proving something and calling it into question. It is much easier to do the latter than the former. The anti-fluoridationists did not need to prove that fluoride was dangerous; they merely had to call into question the notion that it was safe, which could be done either by claiming medical side-effects, citing research that allegedly did so, or alleging division or uncertainty amongst scientists themselves. Accordingly, the typical structure for anti-fluoridation rhetoric was to take a claim made by the pro-fluoridationists (often in the form of a direct or imputed quotation used as a subheading) and then undermine it. In ordinary scientific conduct, this process of critique and emendation would be carried out through the cycle of research and peer-reviewed publication (and occasional retraction). In the pamphlets, there is a home-grown version of this scientific process at work, with the critical 'workings' of correction and clarification shown directly to the public. The influential book *Fluoridation: Errors and Omissions in Experimental Trials* (1959), though published by a bona fide scientist, chose to adopt this para-scientific mode in its second edition (1960). The author, Sutton, reprinted critical reviews of his book by the scientists whose work he had originally described, and interleaved rebuttals of their rebuttals. This could be interpreted (as it was by Sutton) as a necessity due to the biased editorial line, antipathetic to the anti-fluoride movement, of disciplinary journals. Alternatively, it could be interpreted as a means of making explicit a process of scientific critique and development normally hidden from the public.

It is striking that pro-fluoridation propaganda (such as the 1965 Ministry of Health Report no. 105, 'Fluoridation') used the same format as did anti-fluoridationists to undermine the latter's claims. They too structured their leaflets according to commonly held opinions, which were then rebutted. They too cited authorities whose endorsement was supposed to sway the reader. The pro-fluoridationists were also just as guilty of using unreferenced 'facts' to support their case as were their opponents. The trope of a person needing to drink 'two and a half bathfuls' of fluoridated water to suffer ill effects was in fact a recycled factoid from a 1957 pamphlet published in the US by Louis Dublin, the retired head of Metropolitan Insurance Co., Statistical Branch.⁵⁴ As a result, it was difficult for readers to see what was different about the methods and positions of the two sides.

Sociologists have pointed out the power asymmetries of the fluoridation debate in Australia; because the most powerful authorities determined that fluoridation was the 'scientific' way, there was no necessity for the fluoridators to prove their case.⁵⁵ However, epistemologically speaking, a piece of misinformation has the same value as a piece of information that happens to be true, but is circulated with invalid evidence to support it. It is not a constructive tactic to point out and blame misinformation if correct information is indistinguishable from it in rhetorical and epistemological form.

When arguments are considered from a teleological, top-down perspective (judged on the basis of whether they tend to support a sensible policy) then misinformation can succeed and correct information can fail. Many anti-fluoridationists made excellent arguments from the perspective of public health. Why not put fluoride in school milk? Why not focus efforts on stamping out smoking

⁵⁴ The claim is made in Ministry of Health, 'Fluoridation' (London: HMSO, 1965). 2.5 bathfuls was Dublin's estimate of the quantity needed to produce mild symptoms; 50 bathfuls, he judged lethal; cited in 'Medicine: Figures and Facts', *Time* 22 July 1957.

⁵⁵ Brian Martin, 'Analyzing the Fluoridation Controversy: Resources and Structures', *Social Studies of Science* 18.2 (1988): 331–363; pp. 336-7.

instead? These perfectly sensible suggestions tended to sweep misinformation into a slipstream of apparent legitimacy.

Such reasonable proposals were never addressed by authorities, because it was never clear whose responsibility they were to address. They highlight the hopelessly tangled skein of science, medicine and governance that pertained in this case.⁵⁶ It was not the business of scientists to produce policy; but if governors did not explicitly ask scientists to do so, then they were liable to take conclusions made for one set of questions and applied them to another. To put it another way, scientists said 'fluoridation is best', and governors transposed their answer to another context; the question 'best in what regard?' fell between the cracks. For scientists, fluoridation is better than no fluoridation, while in the political sphere, the statement means 'fluoridation is better than other policies or priorities', whether within or beyond dental care. If governors had sought the opinion of scientists on an explicitly policy-based platform, the conversation might have been different.

The 1962 invitation to fluoridate water supplies, issued by the Ministry of Health to local authorities, was the moment when this tangled skein pulled into a vicious knot. Local authorities were in no way scientifically literate, and were dependent on the national Ministry of Health for guidance, which in turn had jumbled science and politics in its presentation of information. There was no point in anti-fluoridationists, even if they had good scientific information, having a scientific conversation with local decision makers, since the latter had only a second-hand version of the facts that was already intermingled with politics. They could only raise their voices ever louder, voicing ever more extreme claims.

6. Conclusion

Purported information crossed international borders easily during the mid-twentieth century. A relatively small number of people, notably at the NPWA, succeeded in packaging it into a form that would influence larger numbers of people, and through them, policies for everybody. The motivations of these top-level gatekeepers were mixed; genuine concern was arguably intermixed for some with a sense of losing social status, or, in the case of women, not having it in the first place. The success of anti-fluoridationists came in part from the fact that they appealed to fundamental concerns amongst the general populace. They also exploited epistemological asymmetries of proof and disproof, as well as a lack of sociological realism about the ability of science to reach irrefutable proofs. Scientists and governors facilitated these strategies by failing to engage in conversations about legitimate doubt, and by presenting science as an unrealistically monolithic method and entity. The role of local gatekeepers in transmitting the work of the national facilitators was crucial. The more localised the mis/information and its sources, the more effective (and more incendiary) it was. Given that social media are best regarded as a radical extension of the private sphere, this presents particular challenges for the present day. Finally, misinformation can be regarded in this episode as a resort of desperation, blooming at policy-making crunch points. Local policy decisions built over structural communication hiatuses between dentists and doctors; between both of these professions and national policy-makers; and between national policy-makers and local

⁵⁶ For more on science and governance see Sheila Jasanoff, ed., *States of Knowledge: The Co-production of Science and the Social Order* (New York: Routledge, 2004); and Don Leggett and Charlotte Sleight, eds, *Scientific Governance in Britain, 1914-79* (Manchester: Manchester University Press, 2016); and for discussion of these themes in recent context see Stephen J. Hilgartner, Benjamin Hurlbut and Sheila Jasanoff, 'Was "Science" on the Ballot? Labeling Dissent as "Anti-Science" is Bad Social Science and Bad Politics', *Science* 26 February 2021: 893-4.

implementation bodies. Misinformation was the loudest possible protest in a system that made reasoned discussion all but impossible.

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