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When evidence alone is not enough: The problem, policy and politics of water fluoridation in England

Dr Gary Lowery, University of Sheffield, UK
Professor Matthew Flinders, University of Sheffield, UK
Professor Barry J. Gibson, University of Sheffield, UK

Abstract

Background: Tooth extractions are the most common cause of hospital admissions for children in England. Water fluoridation has the potential to reduce this number by 60 per cent, is backed by the scientific and public health communities yet is currently consumed by only ten per cent of the population.

Aims and objectives: This 'evidence-policy gap' is explored through Kingdon's 'multi-streams approach' which provides insights into the circumstances under which water fluoridation has made it onto the political agenda, the rationale underpinning opponent and advocate policy positions, and the role of the political arena in fostering or hindering policy action.

Methods: Over 100 primary documents were reviewed to develop an understanding of the scientific and ethical arguments for and against water fluoridation as well as to identify how each have historically sought to mobilize their policy preferences. Eleven consultations were also conducted with stakeholders as part of the knowledge exchange process.

Findings: The key finding of this research is that evidence is only likely to trigger policy change if it emerges into a receptive socio-political context. In substantiating this claim we identify evidence not of an 'evidence-policy gap' but a more complex and multi-dimensional 'evidence-policy-politics gap'.

Discussion: The findings contribute to a range of debates in relation to: (i) the apparent irreconcilability of background ideas about what ought to form the basis of public health policymaking; (ii) the presence of differing evidential standards that create an uneven playing field; and (iii) the central underpinning role of politics in public health policymaking.

Key words:

Water fluoridation, Kingdon, evidence-policy-politics gap, world views

Key points:

Water fluoridation in England is characterised by a disconnect between the evidence base and the policies enacted

This is attributable to a complex, multi-dimensional and dialectical 'evidence-policy-politics gap'

Evidence is only likely to trigger policy change if located within a receptive socio-political context

These insights feed into broader debates surrounding blame-avoidance behaviour and the existence of evidential biases

INTRODUCTION

This article explores the relationship between science and democracy. Its central contribution to the existing research base is the identification of a complex, multi-dimensional and dialectical 'evidence-policy-politics gap' in which evidence of the effectiveness of a policy intervention is only likely to trigger policy change if it exists within a receptive socio-political context. Kingdon's (2011) 'multiple-streams approach' (MSA), applied to the water fluoridation debate in England is utilised to substantiate this argument. Positioned within the existing literature this article exists at the inter-disciplinary inter-section of three seams of scholarship. The first of these is the research concerned with the 'politics of' evidence-*based,* or evidence-*led* policy-making (see Cairney 2016); the second revolves around the 'dysfunctions of democracy' and concerns about the capacity of politicians to take potentially unpopular decisions (see Flinders 2012); and the third around the dynamics of public health, in general, and paediatric oral health, in particular.

The findings are the result of a twelve-month Health Gateway funded research project based at the University of Sheffield's Medical School, undertaken in close collaboration with potential research-users including local NHS Foundation Trusts, British Dental Association, Sheffield City Council and community groups. The inspiration for this research was the November 2018 decision by Sheffield City Council to undertake a first-phase scoping review of the feasibility of water fluoridation in the city. Not only did this provide an opportunity for social scientists to observe the emergence of debates within and beyond the town hall (i.e. the 'politics of' water fluoridation) but also for those academics to support policy-makers through the provision of an independent

analysis of the existing evidence base with regard to the effectiveness of fluoridation and its likely political contestation.

In order to provide this support over one hundred primary documents were reviewed. To ensure that as comprehensive a literature search as possible was conducted five different information sources were used. These included (1) websites of key organizations, most notably Public Health England; (2) electronic databases; (3) forward and reverse citation searches; (4) the House of Commons Library (HoCL); (5) and internet search engines including Google and Google Scholar. This search was broadly delineated along two key strands. The first of these was the scientific/evidence-based literature relating to water fluoridation in academic journals as well as evidence and systematic reviews produced by key government agencies and dental associations, the latter of which are typically understood as residing at the apex of the 'best available evidence' (Cairney, 2016:3). While it is therefore important to acknowledge that 'not all evidence is equal' (Evans, 2003:78) the aim of this strand was to develop a detailed understanding of the broad range of available evidence in relation to water fluoridation. The second strand included legislation, green and white papers, departmental reports, ministerial speeches, parliamentary debates, House of Commons Library Briefing Papers and 'grey literature' dating back to the 1950s including from local authorities and Strategic Health Authorities that had previously attempted to introduce water fluoridation (e.g. Andover, Southampton). Set against this was an evaluation of the on-line and off-line literature produced by anti-fluoridation groups such as Hampshire Against Fluoridation. The aim of this strand was to both develop an understanding of how advocates and opponents mobilize their respective policy preferences in attempts to influence the political sphere and illuminate the broader political context in which decision-making takes place.

So as to (i) verify the accuracy of this desk research and (ii) nurture a more sophisticated understanding of the 'gap' between what evidence suggests and what political decision-making processes deliver, eleven consultations were also undertaken between June and July 2019 as part of the knowledge exchange process. These included representatives from across this broad policy space including local government officials, local public health officials, prominent pro-fluoridation and anti-fluoridation campaigners and representatives from the British Dental Association and Public Health England. These were selected on the basis of their ability to help to fine-tune our understanding of the history of water fluoridation, the quality of the scientific evidence base, the nature of contestation and its political implications.

The research presented is not the first analysis of the politics of water fluoridation. In this regard Brian Martin's *Scientific Knowledge in Controversy: The Social Dynamics of the Fluoridation Debate* (1991) provides a key reference point; as does the work of Winstanley (2005), Carstairs (2010), and O'Hara (2017) on popular resistance to fluoridation at the local level; and the work of O'Neill et al. (2019) on the termination of fluoridation policy in Canada. Yet through this articles focus on water fluoridation in England and its utilisation of Kingdon's MSA several fresh insights are offered concerning (*inter alia*) blame-avoidance behaviour and the existence of 'evidential biases' that resonate with broader debates concerning the social amplification of risk. In order to achieve this article's central objectives, it is divided into two inter-linked sections. The first provides a brief history of water fluoridation in England. The second and most substantive section utilises Kingdon's MSA to tease-apart the 'evidence-policy-politics gap' with which this article is centrally concerned.

I. BACKGROUND

Dental extractions currently constitute the most common cause of hospital admissions for children in England at more than twice the number of those requiring tonsillectomies, the second most common cause (Public Health England (PHE) 2014, 2018). This not only incurs significant financial costs for the National Health Service (NHS), but crucially, for the broader life chances of the child whose ability to learn, thrive, and develop is severely curtailed by a loss of confidence and missed school days (PHE 2018). Water fluoridation has the potential to reduce this number by more than half (PHE 2018), is backed by professional bodies and an overwhelming majority of the scientific community, yet is frequently rejected by decision-makers at the local level against the backdrop of a small but vociferous number of individuals and loosely connected groups who cultivate opposition by framing fluoridation as ethically dubious. These diametrically opposed worldviews (discussed below), exacerbated by water fluoridation's status as a universal public health policy that closes-down the sphere of compromise within which democratic politics generally operates, means that fluoridated water is currently consumed by only ten per cent of people in England (PHE 2014).

The most recent manifestation of this debate is, however, part of the very fabric of 'the saga' (King 2018) of water fluoridation, the latest iteration of debates originating from initial fluoridation projects in the 1950s. This ongoing recurrence is captured by Anthony Downs' (1972:38) identification of "issue-attention cycles" in which problems come into prominence, remain for a short time, and then, though largely unresolved, gradually fade from public

attention. Although referring to environmental issues in the United States (US) even the most cursory review of the saga identified by King (2018) reveals a pattern whereby (i) high-levels of oral disease are recognised and lamented; (ii) water fluoridation is proposed as an evidence-based solution; (iii) barriers arise that increase the political costs of action; which (iv) ensures that fluoridation falls off the agenda; until (v) the next dental crisis explodes and the cycle begins again. Despite acquiring agenda status at various moments, in each case the opening of a 'window of opportunity' did not lead to substantive policy change as the political decision-making structures proved unable or unwilling to proceed. In order to determine why, it is necessary to understand and isolate the interplay between *the evidence*, *policy* and *politics*.

II. UNDERSTANDING THE EVIDENCE-POLICY-POLITICS GAP

Proposals to fluoridate public drinking water are essentially an attempt to 'upstream' policy by addressing the source of a problem rather than dealing with the consequences of the issue later on (i.e. 'down-stream'). 'Upstreaming' is a targeted pre-emptive intervention that forms part of a wider shift towards preventative healthcare. The paradox at the heart of this article, however, is that despite a large body of evidence that suggests fluoridation 'works' politicians and policymakers have been reluctant to follow the evidence and introduce the policy. The aim of this section is to develop a theoretically-informed but policy-relevant understanding of why evidence alone is not enough to cultivate the adoption of a policy that the data suggests could offer major social benefits in terms of addressing socially entrenched health inequalities. The core argument is that Kingdon's MSA provides a powerful analytical framework in this regard as it not only explains *why* water fluoridation has acquired agenda status at specific historical junctures but also *how* opponents have generally been successful at closing the various 'windows of opportunity'.

It is neither possible nor necessary to provide an exhaustive account of Kingdon's (1984, 2011) MSA. It is sufficient to note that it is not a panacea for the challenges of policy analysis (see Robinson & Eller 2010), and that the institutional configuration of the state has become increasingly complex and fragmented since the approach initially created (see Zohlnhofer 2015:412). Yet in a study of 311 applications of Kingdon's MSA between 2000 and 2013 Jones et al (2016:21) found that the flexibility of the core insights and general low barrier to entry means both that: as a heurist or analytical framework it remains one of the most frequently applied approaches to understand policy change; and that its core insights have expanded well beyond its original focus on US federal policymaking to include a diverse number of countries (65), at multiple levels of governance (international, national and sub-national), and across an increasing variety of

policy areas (22) including in public health (see for example Craig et al, 2010; Guldbrandsson & Fossum, 2009).

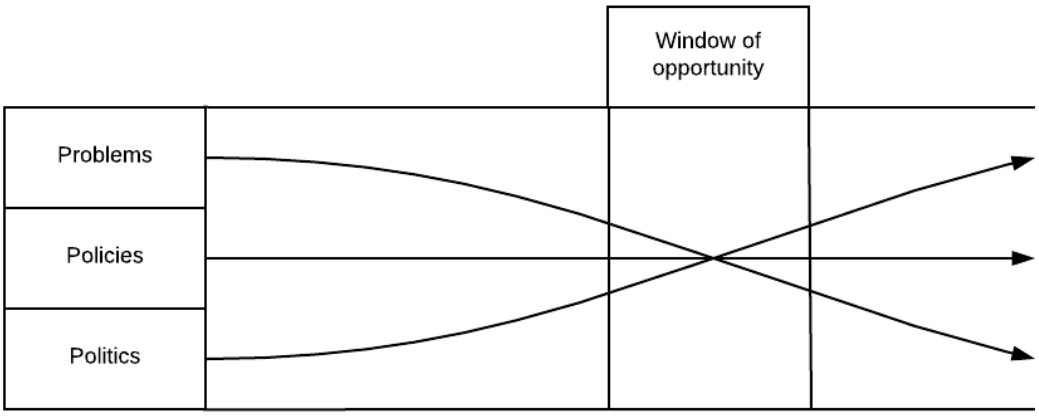
Put simply, the MSA revolves around the idea of *alignment* and whether the following questions receive affirmative responses – (i) Is there a public *problem* that is widely recognised as needing active government intervention? (ii) Does a credible *policy* solution exist that could solve or address this problem? (iii) Is the *political* environment conducive to supporting the adoption of that policy? Each of these questions relates to one of Kingdon's policy streams (see Table 1, below), the central proposition being that policy change only becomes viable once these three streams align (see Figure 1, below).

Table 1. Kingdon's Three Policy Streams:

Stream	Essence
Problem	An issue has to move from being a recognised as a general social challenge or 'condition' to 'a problem' that is viewed as requiring active government intervention. 'Problem brokers' may proactively frame an issue in order to focus attention (media, public, political) on a specific topic; alternatively, a crisis, disaster or catastrophe may serve as a focusing event. Problems can slip off the agenda as quickly as they can explode onto it.
Policy	In order for change to occur a credible policy solution must exist. An array of business organisations, pressure groups, scientists, experts and community groups promote different policies which means that 'policy entrepreneurs' often need to build policy-coalitions and public support ahead of a problem being recognised and placed on the agenda. A broad spectrum of support is likely to be necessary to shift embedded institutional inertia.
Politics	The existence of a recognised 'problem' and the existence of a viable 'policy solution' are, on their own, unlikely to lead to change unless the political context is also favourable. Politicians will assess public sentiment, political costs and possible electoral benefits. Ideological convictions are also likely to affect political strategies which explains why a change in government may close-down or open-up the policy space around a specific problem.

Although Table 1 can be taken as a reasonable proxy for the 'evidence-policy-politics gap' that informs this article, two insights in particular animate the discussion that follows. Firstly, Kingdon's approach answers the basic question as to why when faced with exactly the same problem and the same scientific evidence very different decisions about the need for or scope of policy change occur. Put simply, the extent of difference or even non-decision making is explained with reference to the politics stream, with evidence alone unlikely to be enough to deliver policy change if the political dynamics are not in alignment. This flows into a second insight highlighting the power of path dependencies and institutional 'stickiness'. As a vast literature on various forms of ('new') institutional*ism* has demonstrated, it is generally far easier to derail reform initiatives than it is to drive through change. In order to develop this point, the remainder of this section applies the multiple streams approach to fluoridation with the concluding section focusing on the broader implications of this argument.

Figure 1. Three Streams Combine to open a 'Window of Opportunity'



The Problem Stream

Is it broadly accepted that paediatric oral health poses a significant challenge to society that warrants state intervention? The answer to this question is that in recent years a focus on addressing early-years health inequalities has ensured that paediatric oral health is viewed as a problem. Yet what is interesting about this focus on 'the problem' is how it illustrates that no policy can be analysed in isolation but must be sensitive to the changing social context. In 1948, for example, the 'decay-missing-filled-teeth' (DMFT) index, the most common method for assessing dental caries prevalence (demineralisation of dental hard tissue) and treatment needs,

stood at around three. Yet within a decade not only had the DMFT index almost doubled, a rapidly declining dentist-to-patient ratio meant demand was outstripping the ability of dentists to provide 'downstream' care (Fletcher 1957:847). In 1952 a UK Mission therefore visited the US to assess the effectiveness of water fluoridation where early studies had indicated a significant reduction in dental caries in children exposed to higher levels of fluoride in drinking water. The report of the following year supported these findings while also suggesting that there was no evidence of danger to health when consuming fluoridated water at low concentrations. In December 1953 the government therefore invited a number of local councils to operate as testbeds for fluoridation projects, of which four accepted (Anglesey, Kilmarnock, Andover and Watford) (Whipple 2010:231). Subsequent research into the effectiveness of these trials (see Bransby et al. 1963) provided 'clear evidence of the value of fluoridation as a preventative measure against dental caries' which when combined with studies from around the world provided 'massive evidence' for the extension of water fluoridation throughout the 1960s.

As Kingdon (2011) has shown multiple issues vie for attention on the political agenda, with problem brokers and policy entrepreneurs battling to prevent 'their' problems from being displaced. This matters because water fluoridation fell off the agenda during the 1970s as the number of DMFT in individuals went into reverse (Cochrane 2015:3) the consequence being that dental health was relegated from a recognised problem demanding immediate attention to a more prosaic social condition. The reasons for this are complex but include higher levels of public understanding about the link between sugary food and drink and tooth decay and the introduction of fluoridated toothpaste and mouth rinses which provided a direct challenge to fluoridated water. These factors, the 2015 Cochrane Review noted, contributed to an overall improvement in paediatric oral health thereby partially hollowing-out the claims of water fluoridation advocates. And yet as Mullen (2005:2) notes, although studies in the 1960s had found significant levels of DMFT variation between fluoridated and non-fluoridated areas, sometimes as high as 60 per cent, by the 1980s these levels were still between a not inconsequential 20 and 40 per cent, thereby highlighting the potential efficacy of water fluoridation (see also HoCL 1993).

The *general* improvement of dental health in the UK notwithstanding what has more recently reframed dental health as 'a problem' rather than a general social condition has been an emphasis on evidence of socially embedded health inequalities and their implications for quality of life and social mobility. Public Health England's statement that childhood tooth decay continues to constitute 'a significant public health problem' (2014:4; see also 2018:7) nevertheless veils a deeper problem in the sense that although 12 per cent of three-years-olds and 25 per cent of five-years-olds have caries in their primary teeth Sandra White, dental lead for Public Health England, has

suggested that it is children in the most deprived communities that continue to be hit the hardest. Newton et al (2015:617) for example suggest a twenty-fold variance in tooth decay between the best and worst performing areas (see also PHE 2014:6) with even greater inequalities within local authority areas. This explains why paediatric oral health has been both formally recognised as 'a problem', particularly in areas with high levels of socio-economic deprivation (e.g. Sheffield, Hull) and why water fluoridation (which has the potential to reduce the number of teeth-related hospital admissions for children by as much as 60 per cent (PHE 2018:6-12)) has emerged as a policy solution. And yet despite this evidence water fluoridation has only been promoted in reports and government statements at a distance – which brings us to a focus on the policy stream.

The Policy Stream

Is it broadly accepted that water fluoridation represents an effective and legitimate response to the problem of paediatric oral health inequalities? The conclusion is that a sharp polarisation between 'the advocates' and 'the opponents' means that the status of fluoridation as a legitimate option remains highly contested. The critical element within this polarisation, however, is that the vast weight of evidence and research supports those who advocate fluoridation (see the 2014 PHE Water Fluoridation Health Monitoring Report for a concise summary). And yet the core contribution of this sub-section revolves around the identification of a political tributary within this policy stream and how this politicises the tone and tenor of discussions in ways that arguably diminish the authority of 'the experts'.

Table 2. Competing Worldviews in relation to water fluoridation in the UK

	Advocates	**Opponents**
Central Arguments	Water fluoridation successfully reduces tooth decay Water fluoridation is a safe public health intervention with the only noticeable side effect being mild dental fluorosis	The evidence in support of water fluoridation is of poor scientific quality A number of adverse health effects exist, including Down's syndrome, goitre, hypothyroidism, and bone fractures

	Water fluoridation is justifiable on utilitarian grounds	Water fluoridation is an attack on individual liberty and a form of enforced medication
Emphasis of argument	Technical with some emphasis on ethics	Ethical with some emphasis on technical
Epistemological Angle/ Evidential Bar	Steep/High	Shallow/low
Direction of policy	Top-down	Bottom-up
Structures	Formal / Political	Informal / Protest
Policy community	Technocratic/Pragmatic	Normative/Critical
Claims to speak for the interests of the public	Yes	Yes

The advocates are a fairly homogenous professional group including the British Dental Association and Public Health England as well as academics and scientists who share a common commitment to water fluoridation as an effective and legitimate public health intervention (see PHE 2012, 2014). This position is underpinned by a cumulative body of evidence originating with the early studies of HT Dean et al (1942) in the US, results from the original UK trial areas (Jackson 1974:104), and evidence and systematic reviews which have found no evidence of adverse health effects beyond the potential for low levels of dental fluorosis (typically manifest in a flecking on the surface of the teeth) (McDonagh et al. 2000; see also National Health and Medical Council 2017; PHE 2018:11-13; Public Health Ontario 2018). Despite engaging with opponent claims citing adverse health effects advocates' responses have therefore rested on two evidence-based insights: firstly that such claims are underpinned by older and often fairly poor quality research (see York Review 2000:xiii); and secondly, that the only notable exception is studies exploring ultra-high doses of fluoride, sometimes twenty-times the amount added to England's drinking water which, as with most chemicals, is invariably detrimental to human health. For this reason little credence has been given to claims regarding potentially pathological public health implications (see Martin 1991:8). Or, put slightly differently, the benefits of fluoridation far outweigh the risks.

In their efforts to shape the policy stream advocates therefore, first and foremost, privilege 'facts' and 'data'; a highly technical almost depoliticised 'what works?' approach. In doing so they rarely engage with ethical arguments, and in the instances they do justification is typically couched in utilitarian terms in which the state has a duty to reduce ill-health, something it already does in treating water including through the use of chlorine. This is consistent with a positive conception of liberty in which the freedom of the individual is offset against the perceived benefits of collective action to guard against extreme inequalities. This flows (secondly) into an approach in which advocates lobby ministers, promote fluoridation amongst local authorities, but that generally steers away from (external) active campaigning and direct engagement with the public. This 'off-stage' emphasis is a sensible strategy from the position of maintaining a clear distinction between 'the experts' and the politicians, but the flip-side is that the water fluoridation debate in England has been historically characterised by the lack of a high-profile policy entrepreneur willing or able to quash false claims or clear institutional blockages.

In contrast to advocates, opponents tend not to be academics or scientific experts (although see Dissendorf and Dissendorf 1997; Peckham 2012) but consist of a loosely associated network of small groups and individuals. Their common aim is clear however: to prevent the adoption of water fluoridation; with Local Fluoride Action Networks (Hampshire Against Fluoridation, Fluoride Free Bedford, for example) generally representing the extent of their formal organisation. Central to their approach is the invocation of ethical arguments, particularly the importance of consent in medical interventions, especially where there is a possible risk to health; the implication being that undertaking water fluoridation without the consent of everyone affected is akin to 'forced medication'. Added to this, the Nuffield Council on Bioethics (2007) suggest, are ethical concerns surrounding the state intervening to restrict freedoms in such a manner as to coerce individuals into leading healthy lives. This critique resonates with Rousseau's arguments concerning being 'forced to be free' with opponents adopting a clear affiliation with negative freedom-from conceptions of liberty (hence the emergence of an increasingly specialised and sophisticated literature on public health ethics, see Dawson and Verweij 2008).

Despite this emphasis on ethics opponents do engage with debates concerning the scientific evidence base by referencing a relatively thin and highly contested seam of scholarship that either claims or seeks to suggest a relationship with negative health effects. This is drawn upon to dilute and question the claims of advocates and ranges from Rapaport's work in the 1950s and 1960s on Downs syndrome (1956; 1963), Day and Powell-Jackson's 1972 work on goitre, the Dissendorfs' (1997) warnings about fluoride over-consumption among infants, the Royal Society of New Zealand's (2014) focus on the potential for skeletal fluorosis, the work of Choi et al. (2015) on IQ

levels amongst Chinese school children, and Peckham et al.'s (2015) suggestion of a link between water fluoridation and hypothyroidism.

Whereas advocates seek to 'influence-up' through formal internal processes opponents influence the policy stream by cultivating opposition at the local level, a highly effective strategy for a number of reasons. First, it is relatively easy to criticise 'the experts' for being part of a disconnected and insular elite (Lockie 2017). This claim is partially (and secondly) reinforced by the fact that very few advocates are willing to participate in (often ethical) public debates instead generally sticking to a technical presentation of the facts that struggles to chime with the public at an emotional level for the simple reason that (thirdly) they work in a professional context in which facts, data and peer-reviewed research is the main currency. Added to this (fourth) is the requirement that public service broadcasters provide a balanced account of controversial debates. Yet Grimes (2016) has illustrated the potentially problematic nature of treating all views as equally valid (especially when evidence is clearly weighted on one side) when it comes to promoting public understanding and addressing major social challenges.

This flows into our final point that there exists a steep 'epistemological angle' that places asymmetrical evidential expectations on each side of the debate. The advocates are expected to demonstrate that water fluoridation is completely *risk free* (i.e. they face the thick end of the epistemological angle). Opponents, however, need simply highlight ethical concerns while recruiting a small number of scientists willing to emphasise the inevitable *existence of residual risks* (i.e. they face the thin end of the epistemological angle). This is made much easier in the context of a 24/7 rolling news media, increasingly sensationalist reporting, on-line media with few (if any) quality controls, and concern regarding 'alt-facts' where it is relatively easy for a small number of opponents to denigrate advocates and promote bad science.

It was set against this context that in an 'evidence-informed toolkit for local authorities' published in March 2016 promoting the fluoridation of public water, Public Health England (2016:22) provided the following warning to local authorities.

> Experience over many decades of fluoridation in the UK and internationally has shown that *there are people who make a range of untrue assertions and claims about fluoridation which can have a disproportionate impact on public opinion if unchallenged.* Experience has also shown that in those parts of the country where fluoridation schemes have operated for many years it is not an ongoing issue of controversy for the general population [emphasis added].

Yet the paradox that this article seeks to bring to the fore - and central to debates concerning the 'politics of' evidence-based policy – is that promoting 'bad science' may in fact represent 'good politics' when it leads to non-decision-making and blame-avoidance behaviours. In this respect, the steep 'epistemological angle' arguably has real-world implications when it comes to understanding why politics so often seems to fail (see Flinders and Wood 2015). This leads us to consider the politics stream.

The Politics Stream

The insights of the previous section have important implications for understanding the politics of evidence-based policy both 'as theory' and 'as practice'. From a theoretical position it highlights the problematic nature of attempts to disentangle the three streams when confronted with the messiness of practical politics. Claims regarding the ethics or safety of specific policies will themselves be subject to political game playing *before* they reach the formalised political decision-making structures. This can be viewed as a 'two-level game' whereby the first stage involves lifting a policy out of 'the primeval soup' (Kingdon 2011:116) of multiple and competing policy options. Only when the policy is viewed as a legitimate and appropriate response to the problem does it enter the second level of the game and become the focus of detailed discussion within formal political structures. What the previous sub-section illustrated however was the success of opponents to negatively *politicise* water fluoridation within the policy stream so that it would not be considered a credible option by politicians. Advocates, by contrast, sought to *depoliticise* the policy by emphasising the solid evidence base regarding safety and effectiveness. This sub-section develops this point by: (i) illustrating the historical prevalence of politicisation strategies by opponents; and (ii) revealing how this has led to blame-avoidance strategies by politicians.

When the UK government approved the first local trials of fluoridation in the mid-1950s the Ministry of Health was acutely aware of the need to control the inevitable controversy this decision would create. A public health information pamphlet was therefore produced for local distribution that stated 'it has been proven all over the world that if the amount of fluoride is ONE PART PER MILLION the reduction in dental health decay is about 60%', and that 'it is not a mass medication in any sense', but rather 'like iron in flour and vitamins in margarine, fluoride is only added for the sake of health' (quoted in O'Hara 2017:217 (emphasis in the original)). And yet local opposition still emerged, organised by groups such as the British Housewives League and Scottish Housewives Association. These not only challenged the evidence base but also adopted a range of protest activities including writing to local newspapers, organising rallies, hosting public meetings

and organising a 'Voters' Veto' (a pledge not to vote for council candidates supporting water fluoridation).

Opponents enjoyed considerable success in these early interventions, with one of the trial areas (Andover) withdrawing after only two years. Most pertinently, however, the visceral nature of the debate confirmed within Whitehall and Westminster that fluoridation, despite its potential benefits, was a highly controversial and politically risky strategy to support. This led to a distinctive shift in the politics of water fluoridation that chimes with Hood's (2002) work on 'the risk game and the blame game' whereby ministers proved unwilling to legislate to impose fluoridation but instead delegated plenipotentiary powers to local authorities so that they assumed responsibility for decision-making, with the role of central government restricted to promoting public health and supporting those authorities. Yet as O'Hara (2017) demonstrated, the unseating of pro-fluoridation candidates in early trial areas served as a stark warning to other councils about the highly politicised nature of the topic.

In 1974, however, local authorities in the UK lost their public health powers and the responsibility for making decisions about fluoridating a public water supply which shifted to area and regional health authorities. Under this system water fluoridation could only go ahead once the local health authority had made a written application to the relevant water company; who, although in theory concerned with technical feasibility rather than political or ethical concerns, frequently rejected health authorities' requests to fluoridate water supplies for non-technical reasons, including Bristol and Welsh Water. More explicit in their direct objection was Cornwall's Regional Water Authority which rejected the health board's pro-fluoride recommendation in 1975, with the Chairman of the Water Board noting that 'of all those who have been in communication with us at least 99% of the public are against' (Howell quoted in O'Hara 2017:233). North West Water rejected similar such requests on the basis that there should be no additional fluoridation of water unless there was evidence of substantial support from its customers (see HoCL 1993:4).

Looming large over the debate at this time was the spectre of thalidomide, a healthcare disaster which illustrated the consequences of the failure of rationalism and progressivism. Such concerns were directly referenced by Woking and District water company which noted that "they do not regard it as their duty to add fluoride", and that "it took a longer period than five-and-a-half years before the effect of thalidomide on unborn babies made itself manifest" (quoted in O'Hara 2017:235-236). This reticence to be incorporated into the politics of water fluoridation was captured by Sir John Page, head of the Water Companies Association, who noted that "water companies have no wish to involve themselves in these issues, and certainly they are not medically

competent to do so", with requests to fluoridate local water supplies "putting on water companies and water authorities a burden they should not be asked to carry" (quoted in HoCL 1993:5).

Despite only a very small number of fluoridation projects being initiated after 1974, further legislative reforms followed with the *Water Fluoridation Act* (1985), *Water Industry Act* (1991) and *Health and Social Care Act* (2001) which abolished regional health authorities and replaced them with Strategic Health Authorities (SHAs). In 2003, as part of this broader reform initiative, *The Water Act* (2003) placed a duty on water companies to comply with SHA requests to fluoridate drinking water. This was strengthened with the Water Supply (Fluoridation Indemnities) (England) Regulations 2005 which set out the terms of an indemnity to be provided by the Secretary of State for Health to water companies operating fluoridation schemes.

Notwithstanding these advances the aggressive and polarising debates that fluoridation produces within local communities ensured that most SHAs did not utilise their powers. A notable exception was the 2008 decision by the South-Central SHA to fluoridate local water supplies to combat low levels of paediatric oral health (see Southampton City Council 2008:6). "The safety and effectiveness of water fluoridation has been confirmed by a large number of respected health organisations, research from existing schemes which have been running for 60 years in the UK and worldwide, and the advice from internationally-respected local experts" the local Public Health Director confidently asserted (Mortimore, quoted in *The Telegraph* 2009).

And yet in a case that encapsulates the different 'worldviews' whereas the trust foregrounded the evidence base that it thought would convince the local public; opponents, by contrast, were attuned to the fact that to view water fluoridation through strictly instrumental terms is to overlook an under-appreciated fact: that 'feelings tend to trump facts' (see Flinders 2020). This is especially true of the water fluoridation debate in which a myriad of examples have demonstrated that if an individual, group or community *feels* that a proposal is wrong or risky (or right and safe) no amount of 'evidence' or 'data' is likely to change their mind (and may even entrench their beliefs).

This point was not lost on opponents who not only questioned the credibility of the science but repeatedly utilised emotive ethical arguments concerning freedom of choice which were, in turn, adopted by politicians. The local MP, for example, noted that his constituents were "against the principle of using the water supply to medicate people who had not chosen to be medicated"; the county council leader Roy Perry adopted a very similar position in expressing his concerns "about proposals to compulsorily medicate the population via the water supply" (quoted in *Southern Daily Echo* 2014). The evidence alone was not enough to drive policy change and in the end the proposals were not implemented due to a combination of the opponents bringing a drawn-out judicial review

case, and the next wave of NHS restructuring which saw the abolition of SHAs in March 2013 as a result of the *Health and Social Care Act 2012*.

Table 3. Combined Issue-Attention Cycle and Multiple Streams Approach

Issue Attention-Cycle	*Moment (historical point)*	1952	1974	2003	2013
	Visibility (on the agenda)	**Yes**	**Yes**	**Yes**	**Yes**
	Governance (institutional shift)	**Yes** Ministry of Health interest, plus local pilots.	**Yes** Regional Health Authorities	**Yes** Strategic Health Authorities plus provisions under *Health and Social Care Act* 2001	**Yes** Responsibility for public health returns to local authorities under the *Health and Social Care Act 2012*, plus 2019 Green Paper.
Multiple Streams Approach	*Problem (broad recognition)*	**Yes**	**Yes**	**Yes**	**Yes**
	Policy (credible solution)	**No**	**No**	**No**	**No**
	Politics (committed support)	**No**	**No**	**No**	**No**

This latest piece of legislation, after a gap of almost forty years, returned a leading public health role to local government with a new duty to take the steps they consider appropriate for improving the health of the people in their local areas, including functions around oral public health generally and water fluoridation in particular. And yet in an ongoing process of authority delegation

ministers once again failed to legislate for, or in some other way impose, fluoridation. To the contrary, by simply continuing to encourage its introduction rather than risk becoming embroiled in debates/accusations of 'mass medicalisation', this ensured that the 'arm' in the 'arm's-length relationship' remained fairly long. The latest iteration of this authority delegation/blame avoidance behaviour arguably came with the publication of the *Advancing our Health* green paper of July 2019 which, despite containing an explicit commitment to water fluoridation, only went so far as to offer a number of suggestions for ways in which the incentive structure for local authorities might be amended to stimulate consideration.

In doing so little substantive effort was once again made to fundamentally address the (ir)rationalities embedded within political competition which make it difficult to change the incentive system. That is, while it can be seen to be rational strategic behaviour, a classic mode of statecraft, for national politicians to delegate responsibility for such a highly controversial topic, and even rhetorically justify this through recourse to local choice, it nevertheless belies the question: why would local politicians be expected to engage in a 'risk game' concerning fluoridation any more than national politicians? This question is particularly acute when looked at from a simple cost-benefits perspective that appreciates the following three points: (i) the electoral cycle is relatively short but the benefits of water fluoridation often takes years to become apparent; (ii) the target constituency in healthcare terms of fluoridation is younger children but in political terms this is constituency without a vote; and (iii) although much of the contemporary rationale for fluoridation is focused on addressing severe social inequalities in areas of high deprivation these are also the areas where the electorate is least likely to vote (Solt, 2008). The cost-benefit trade-off *vis-à-vis* suggesting that fluoridation should even be considered is therefore unlikely to be attractive to many politicians.

III. CONCLUSION

If public health policymaking is grounded in attempts to understand the causes and consequences of death, disease and disability, the water fluoridation debate attests to the fact that even greater struggles emerge when attempts are made to operationalise evidence. Although science has the potential to identify solutions to pressing problems, it is nevertheless dependent upon politics to balance these against (often competing) ethical considerations in such a manner as to turn policy into reality. This has three broader implications for the interplay between 'evidence', 'policy', and 'politics'.

Firstly, although the scientific and ethical controversies represent an important aspect of the water fluoridation debate, we nevertheless suggest that these are the manifestation of a much more fundamental divide about what ought to form, and inform, the basis of public health policymaking. What we are centrally concerned with, therefore, is highlighting the presence of not simply two competing sets of ideas regarding the effectiveness or desirability of water fluoridation, but a more fundamental divide, one scientific/technical and the other normative/valuative. Each of these speak not just at cross purposes, but on the basis of commitment to a coherent and defendable, yet entirely different set of ideas and conceptual vocabulary, thereby helping to entrench their apparent irreconcilability.

Secondly, the corollary is that despite a rhetorical shift to evidence-based policymaking water fluoridation in England has been characterised by a clear disconnect between what the evidence shows is effective and the policies that are, or in this case are not, enacted, with the evidence base being clearly insufficient to translate into government legislation. Underpinning this disconnect are fundamentally different evidential standards which create an unlevel political playing field when debates and consultations are undertaken at the local level. The consequence has been that opponents have been able to inject sufficient doubt about the potential health benefits of water fluoridation in such a manner as to build inertia into the system and prevent the introduction of a much-needed public health intervention.

Finally, underpinning each of the foregoing is the central role of politics in public health policymaking. What this article has revealed in relation to water fluoridation in England is that although there have been a number of potential reform 'moments' these never developed into fully-fledged 'windows of opportunity' as the need for policy change failed to find a receptive socio-political context. This is attributable in large part to the fact that the evidence base has always been so vigorously contested by opponents that the 'policy stream' was not aligned (i.e. there was no clear and broadly accepted policy solution in place) which, in turn, almost turned-off the 'politics stream' as no clear policy entrepreneurs with the capacity to drive change emerged. Further exacerbating this point is the fact that water fluoridation is a politically risky policy precisely because it produces a form of protest politics which is always loud and sometimes aggressive, the result of which is that the political decision-making structures have proved either unable or unwilling to proceed at various junctures. This explains why, despite a cumulative body of evidence that fluoridation is a low-risk, low-cost and effective policy response to the frequency and severity of dental decay, evidence alone has not been enough to drive policy change.

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GL, MF and BG conceptualised and designed the study. GL wrote the first draft of the manuscript with comments from MF and BG. MF revised the manuscript with comments from GL and BG. GL and MF conducted literature analysis and interpretation. BG provided scientific input.

Conflict of interest

The Authors declare that there is no conflict of interest.

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Ethics

The author(s) of this paper has/have declared that research ethics approval was not required since the paper does not present or draw directly on data/findings from empirical research.

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Figure 1. Three Streams Combine to open a 'Window of Opportunity'

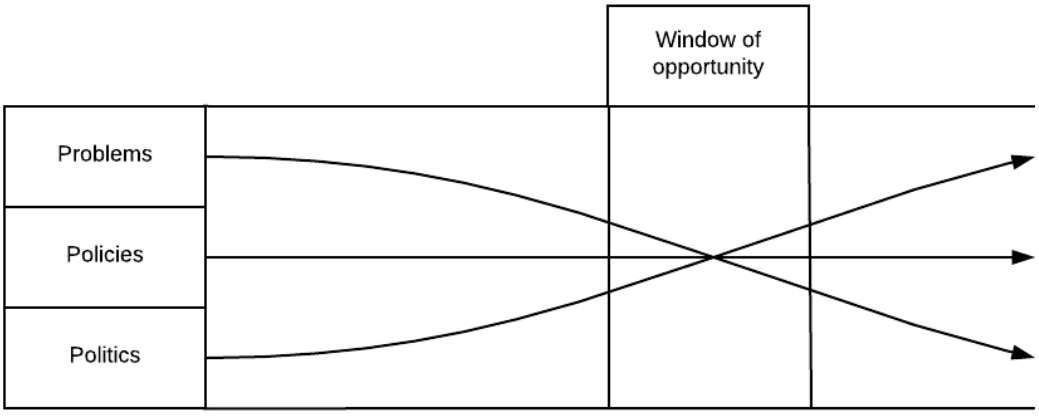

Table 1. Kingdon's Three Policy Streams:

Stream	Essence

Problem	An issue has to move from being a recognised as a general social challenge or 'condition' to 'a problem' that is viewed as requiring active government intervention. 'Problem brokers' may proactively frame an issue in order to focus attention (media, public, political) on a specific topic; alternatively, a crisis, disaster or catastrophe may serve as a focusing event. Problems can slip off the agenda as quickly as they can explode onto it.
Policy	In order for change to occur a credible policy solution must exist. An array of business organisations, pressure groups, scientists, experts and community groups promote different policies which means that 'policy entrepreneurs' often need to build policy-coalitions and public support ahead of a problem being recognised and placed on the agenda. A broad spectrum of support is likely to be necessary to shift embedded institutional inertia.
Politics	The existence of a recognised 'problem' and the existence of a viable 'policy solution' are, on their own, unlikely to lead to change unless the political context is also favourable. Politicians will assess public sentiment, political costs and possible electoral benefits. Ideological convictions are also likely to affect political strategies which explains why a change in government may close-down or open-up the policy space around a specific problem.

Table 2. Competing Worldviews in relation to water fluoridation in the UK

	Advocates	**Opponents**
Central Arguments	Water fluoridation successfully reduces tooth decay Water fluoridation is a safe public health intervention with the only noticeable side effect being mild dental fluorosis	The evidence in support of water fluoridation is of poor scientific quality A number of adverse health effects exist, including Down's syndrome, goitre, hypothyroidism, and bone fractures

	Water fluoridation is justifiable on utilitarian grounds	Water fluoridation is an attack on individual liberty and a form of enforced medication
Emphasis of argument	Technical with some emphasis on ethics	Ethical with some emphasis on technical
Epistemological Angle/ Evidential Bar	Steep/High	Shallow/low
Direction of policy	Top-down	Bottom-up
Structures	Formal / Political	Informal / Protest
Policy community	Technocratic/Pragmatic	Normative/Critical
Claims to speak for the interests of the public	Yes	Yes

Table 3. Combined Issue-Attention Cycle and Multiple Streams Approach

Issue Attention-Cycle	*Moment (historical point)*	1952	1974	2003	2013
	Visibility (on the agenda)	**Yes**	**Yes**	**Yes**	**Yes**
	Governance (institutional shift)	**Yes** Ministry of Health interest, plus local pilots.	**Yes** Regional Health Authorities	**Yes** Strategic Health Authorities plus provisions under *Health and Social Care Act* 2001	**Yes** Responsibility for public health returns to local authorities under the *Health and Social Care Act 2012*, plus 2019 Green Paper.

Multiple Streams Approach	*Problem (broad recognition)*	**Yes**	**Yes**	**Yes**	**Yes**
	Policy (credible solution)	**No**	**No**	**No**	**No**
	Politics (committed support)	**No**	**No**	**No**	**No**