Collaboration, vision and reality: water fluoridation in New Zealand (1952-1968)

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SUMMARY

In comparison with that of other nations in the British Commonwealth, New Zealand’s early and comparatively high adoption of water fluoridation was a distinctive health policy. National concerns about the caries epidemic and the legacies of TR Hunter, F Truby King, HP Pickerill and JP Walsh engendered a spirit of cooperation between the Department of Health, the New Zealand School Dental Service, the Medical Research Council (of New Zealand), the New Zealand Dental Association and the University of Otago’s dental and medical schools. The consequence was a contagious culture of multidisciplinary research and institutional liaisons that produced exceptional dental epidemiology. The government’s involvement in children’s public dentistry harmonised with fluoride advocates’ radical vision of community caries reduction. New Zealand assumed not only a leading international role in immediate post-World War cariology, but also the dominant position in the fluoride politics of the British Commonwealth. The incomplete fulfilment of Fuller’s “Dreams Pursued” presents a case study that confirms the roles of both scientific evidence and centralised political authority in public health administration. Paradoxically, political scientists have largely ignored New Zealand’s early adoption of water fluoridation. This paper addresses this deficiency.

BACKGROUND

Analyses of events or data can result in differing interpretations depending on the perspectives and bias of those involved. Moreover, the long evolution of community water fluoridation has a genesis anchored in the duality of nature: bioavailable fluoride has a potential for both therapy and toxicity. This milieu explains not only why adjusted water fluoridation remains amenable to both challenge and misrepresentation, but also why early fluoride advocates had to convince the government of a well-researched and positive role for this halide. This milieu explains not only why adjusted water fluoridation remains amenable to both challenge and misrepresentation, but also why early fluoride advocates had to convince the government of a well-researched and positive role for this halide. In spite of international endorsement of community water fluoridation as a public health strategy, analyses of public reaction to it continue to fascinate a small number of social scientists. In this regard, New Zealand’s early uptake of community water fluoridation is distinguishing. While the scientific agenda was planned and visionary, the socio-political background remains poorly analysed. The explanation is simple. When behavioural and political scientists investigate why municipalities ignore, defer, reject or implement fluoridation, their research methods face many variables and confounding factors (Crain et al., 1969; Akers and Porter 2008). In this regard, New Zealand is again unusual. Its topography, demography, constitution and public dental policies contributed to the pre-1968 acceptance of water fluoridation. However, other influences were relevant. This paper identifies centralised authority—which evolved from the culture of research, organisational cohesion and political resolve—as being another major and poorly recorded consideration in New Zealand’s fluoride story.

Topography and demography

The United States Public Health Service’s unqualified endorsement of community water fluoridation on 24 April 1951 (Dean, 1951) generated consequences in New Zealand, where the intersection of topography and demography heightened researchers’ interest. New Zealand is a compact, urbanised nation inhabited by a population that, in 1945, held “the world record for annual average per capita consumption of sugar - well over 100 lb...and the world’s worst teeth” (Tuckfield, 1945). New Zealand’s geography and patterns of settlement generated sufficiently large and accessible communities, and this facilitated field studies into dental caries and enamel fluorosis, and allowed fluoride advocates to personally submit their case in front of well-attended meetings. The New Zealand Dental Journal regularly recorded face-to-face dialogue, and effective communication was one reason for the unified public voice of the New Zealand Dental Association (NZDA). Urbanisation and relative proximity also consolidated municipal water infrastructure and enhanced the economics of fluoridation so that comparatively few decisions could provide fluoridated water for many citizens (Fuller, 1962). This background laid the foundation for a provincial municipal authority (Hastings Borough Council) to achieve international acclaim in early 1953, when it implemented fluoridation. The timing of the council’s 1952 decision to fluoridate was fortuitous, because organised international opposition to fluoridation was just starting to emerge (Crain et al., 1969). The programme, a first for a community outside North America, involved a ten-year trial of optimally fluoridated water for 20,000 residents.

Climate carried consequences for water (and hence fluoride) intake and excretion (Galagan, 1953) and New Zealand’s comparability with the climate of the North American field trials was another pivotal consideration in Hastings’ distinction. Excluding the mineral water at Rotorua, the Raglan factory bore and the Patea region, New Zealand’s ground and surface water contained sub-optimal bioavailable fluoride concentrations (Bell, 1952; Hewat, 1949; Stilwell et al., 1957). Although evidence suggested the presence of “dental mottling” in the volcanic eruption areas of the North Island (Burt, 1943), and idiopathic “questionable or mild dental mottling” in “say, 5%” of school children in the lower half of the North Island (Hewat 1949), endemic enamel fluorosis was not a public concern (Stilwell et al., 1957). In spite of strong national interest in soil science, New Zealand’s scant mention in the agrarian and relevant veterinary literature suggests non-toxic bioaccumulation of fluoride in and on soil and vegetation (Mitchell and Edman, 1945; Robinson and Edginton, 1946). More importantly—and...
Unlike the situation in Queensland (Akers and Porter, 2004; Akers and Porter, 2007) — New Zealand researchers dismissed endogenous fluoride exposure and the conversion of fertilizer-sourced fluoride in pasture (Harrison and Bell, 1947; Stilwell et al., 1957). Few reports of animal dental fluorosis had emerged despite sheep grazing over much of New Zealand (Cronin et al., 2000). Industrial pollution, if it existed, attracted little interest. Hence, the topography, climate, patterns of settlement and fluoride concentration in surface and ground water meant that fluoride advocates could dismiss many of the confounding variables that hampered the international extrapolation of the fluorine-caries hypothesis.

Constitutional and sociopolitical backgrounds were also relevant to New Zealand’s prospects for fluoridation. The national and local system of government meant that no state administration complicated political or administrative decisions. A post-1950 unicameral and cabinet-dominated parliamentary system embraced taxation, health and welfare, and concentrated political and fiscal responsibility for both decisions and their implementation. The outcome was an enduring national commitment to dental treatment that, in the 1950s, included the New Zealand School Dental Service (NZSDS) and the Dental Benefit Scheme for adolescents. The former was a government-run service and the latter a government-funded scheme administered through private dental practice. This public healthcare model attracted international interest (Bradlaw et al., 1951; Greubbel, 1951; Saunders, 1951). The result was government expenditure of £4,000,000 on “fees paid direct to dentists or indirectly via taxation in support of Dental Benefits under the Social Security” by 1951 (Whyte, 1952). Hence, the national government had a direct fiscal involvement in public dental policy.

The culture of dental research

After World War II, the University of Otago Dental School produced evidence that empowered the emerging case for artificial water fluoridation. This desire for formal investigation had diverse origins. In 1907, the School’s Director (HP Pickerrill) acknowledged the role of the “founding fathers of Otago University” (Brown, 2007). However, Pickerrill set a benchmark for investigation into both dental caries and dental public health, research into which involved the NZDA and the New Zealand Dental Journal, where Pickerrill also played important roles as Secretary and Editor respectively. JP Walsh, later School Dean, believed an important factor in the school’s high profile and strong culture of research was its location in Dunedin, “where the Medical School had been established some thirty years earlier, and where an appreciation of the value of higher education, often characteristic of smaller communities, had already taken root” (Walsh and Craddock, 1950). The Dental School was “one of the first in the British Commonwealth to be directly affiliated with a University” and, under Walsh’s stewardship, blended British and US traditions. The latter influence emphasised prevention and partly explained the Faculty’s careful monitoring of developments in the North American field trials on water fluoridation. However, Walsh capitalised on Pickerrill’s prior authority and forged another alliance that later enhanced the prospects for community water fluoridation. While the Dental Faculty retained its independence, Walsh maintained a “close liaison with Medicine” (Walsh and Craddock, 1950) and that collaboration is clearly apparent in the literature. ME Bell and MF Harrison, nutritionists in the Department of Nutrition at the Dunedin Medical School provided multidisciplinary reviews of dental caries and fluoride (Bell, 1952; Harrison and Bell, 1947; Harrison, 1949). Bell spent over thirty years studying fluorides and was an expert on its physiology, biochemistry and toxicology. Harrison focused on the dietary intake and excretion of fluoride. Their stature and findings enhanced the prospects for implementing community water fluoridation. Multidisciplinary publications in the New Zealand Dental Journal confirm a rich culture of research, including dental epidemiology. This integrated evidence was rare outside North America and further strengthened the case for water fluoridation.

The Otago Dental School was New Zealand’s only dental school, and it enjoyed fortuitous circumstances. Sir Thomas Hunter’s gift of £10,000 underpinned post-1947 prospects for multidisciplinary dental investigations. This explained Walsh’s comment in 1950: “Funds for research have been provided in recent years on a generous scale by Government, University, and private grants” (Walsh and Craddock, 1950). Davies’ agreed, but continued: “the strong tradition of preventive dentistry and the cooperation between medical and dental research produced a contagious culture of research….and, of course, there was Walsh’s leadership.” While Walsh was an astute manager, a prolific author and actively encouraged research, it was GN Davies—Head of the Department of Preventive, Public Health and Children’s Dentistry from 1948 to 1963—who became the focal point of literature on cariology. Davies authored nationally-distributed NZDA booklets on dental caries (Davies, 1949) and fluoridation (Davies, 1955; Davies, 1956) and embarked on a distinguished academic career involving “102 papers, 1 book and 5 monographs” (Davies, 1997). Davies provided the intellectual platform from which fluoride campaigns were launched.

Another notable feature of New Zealand research was the focus by the Department of Health and the Medical Research Council (MRC) on field studies. By the early 1950s, researchers had demonstrated both the ubiquity of the dental caries epidemic and the failure of preventive strategies and the NZSDS to control it (Hewat 1948; Davies and King, 1951; Davies 1953). This happened against a backdrop where the NZDA played a perennial and distinctive role in the development of the nation’s public dental services. The NZDA spoke authoritatively for its members and published scientific findings and vigorous debate through the only nationally distributed dental journal, the New Zealand Dental Journal. Moreover, the NZDA’s support for the 1921 introduction of government-employed “cutting auxiliaries” via the NZSDS demonstrated the profession’s commitment to community dentistry (Leslie 1953; Nash 1943). However, the “Father of the New Zealand School Dental Service,” Sir Thomas Hunter, contributed far more to New Zealand dentistry than the NZSDS and grants. His real legacy was government and NZDA interest in dental public health. Other developments which corroborated this association were: the founding of the New Zealand Dental Council in 1936 (Wilkinson, 1957); post-World War II rehabilitation of New Zealand Dental Corps members (Brooking, 1980); and plans for a national approach to dentistry (Fuller, 1943; Wilkinson, 1957). In his 1957 valedictory address, NZDA President HS Wilkinson summarised liaison with the government: “But let it be clearly understood that this has only been because our advice placed a high priority on the benefit and welfare of the people…” (Wilkinson, 1957). The NZDA’s historical

1 GN Davies, personal communication, 2003
commitment to the dental health of the public partly explains its early fascination with community water fluoridation (Burt, 1943). Moreover, when the NZDA, the MRC and the Department of Health spoke in concert, the government tended to listen.

Such an account ignores another distinctive institution that played a key role in the public acceptance of fluoride supplements and community water fluoridation. In 1907, Sir Truby King founded the Royal New Zealand Society for the Health of Women and Children, known as the Plunket Society. King described dental caries as the “most urgent and gravest of all diseases of our time - a more serious national scourge than Cancer or Consumption” (King, 1935). Although the Plunket Society hierarchy was not always on favourable terms with the Department of Health (Bryder, 2004), it was an independent social force and commanded government attention. Davies observed: “Plunket nurses went into homes and weighed and monitored babies. They would talk about fluoride... They were a major factor in the New Zealand uptake of fluoridation.” Official statistics validate Davies’ assertion. In 1950, Plunket nurses monitored 40,000 pre-school children and 85% of all infants born in New Zealand (Royal New Zealand Society for the Health of Women and Children Inc, 1961). Between 1950 and 1960, these statistics rose to 90,000 and 90 percent respectively. While not mentioning water fluoridation, both Walsh and Whyte confirmed Plunket nurses’ role in personally communicating preventive dental strategies (Walsh, 1965; Whyte, 1952). Here, Bell undertook another key task. Her Department made fluoride tablets, and these were distributed to interested mothers by Plunket nurses (Fuller, 1997). Although their role in the early fluoridation of New Zealand remains poorly acknowledged, Plunket nurses became an infantry for fluoride advocates. Of course, and again evidence is scarce, it is also reasonable to suggest that the NZSDS nurses played a similar role at the dental chairside. Outside the United States, this institutional support for fluoridation was distinctive.

The Department of Health was also an essential participant. Departmental advisors provided internal advice to government, initiated field research and substantiated the counsel coming from the NZDA and the University of Otago. Departmental heads were also fluoride advocates. J Saunders, the Director of Dental Hygiene from 1935 to 1955, played a central role in running the NZSDS and contributed regularly to the international literature on public health dentistry. His successor, JB Bibby, maintained strong connections with US fluoride researchers and continued the support for water fluoridation. Another common denominator among many of New Zealand’s fluoride advocates was their war service. It acted as a catalyst for their conviction to curb the dental caries epidemic. J Ferris Fuller, Assistant Director of Dental Services in the Second New Zealand Expeditionary Force (and NZDA stalwart), wrote: “I had been deeply scarred by my war-time experience…an average DMF of 22, which included a decayed index of 11 with 18–21 overseas…Clearly we had failed at home” (Fuller, 1997). Fuller—whose military career confirmed his initiative and organising ability—emerged as the tactical mastermind in the campaigns for fluoridation (Davies and Plummer, 2001; Ross, 2001). Hence, in the early 1950s, alliances between key personnel and institutions began to materialise.

The NZDA’s Council of Dental Health Education integrated the roles of academic and government personnel (Good, 1950). Relying on the library at the University of Otago School of Dentistry, where Hunter’s grants and Walsh’s priorities provided a rich resource, the Council reviewed the international literature and published abstracts in the New Zealand Dental Journal and the media. This co-ordination contributed to public concerns about dental health. Although Fulton reported the NZSDS’s restorative successes on 7-to-14-year-olds (Fulton, 1951), matters came to a head when Davies and King investigated 304 children and young adults and concluded: “treatment services failed to keep pace with the annual increment of new carious surfaces” (Davies and King, 1951). This finding was soon reaffirmed in older cohorts (Davies, 1955; Cooper, 1955). Another problem was the scarcity of dental personnel, with 850 dentists and 600 NZSDS nurses servicing 2,164,000 New Zealanders (Brice, 1956), and the careers of NZSDS nurses being particularly brief (Walsh, 1952; Saunders and Walsh, 1952). Clearly, dental caries remained a national problem in spite of contributions from the Department of Health, the MRC, the NZDA, the NZSDS, private dental practitioners, and Plunket Nurses. This setting explains the early push for fluoridation in New Zealand.

The fluoridation of Hastings

Armed with national epidemiology and international evidence and a radical vision of community caries reduction, fluoride advocates persuaded the Hastings Municipal Borough to set plans in motion that led to artificial fluoridation of Hastings’ water supply. Given subsequent developments at Hastings, the background to the decision warrants scrutiny. Fuller alluded to an early 1950s alliance between himself and the former President of the NZDA and MRC dental research field officer, R Hewat, whose work focused on the Hawke’s Bay region and thereby included Hastings (Fuller, 1997). Hewat “was influential in persuading local dentists to consider the advocacy of a fluoridation trial in the area.” Davies concurred but added other factors: “a fortuitous NZDA conference…[NZDA President] Whyte was from Hastings and had caught the attention of the Hastings Council”. Fuller confirmed that Whyte approached the Hastings Borough Council (Fuller, 1997). An editorial in the New Zealand Dental Journal (Editorial, 1952) and other reports (Stillwell et al, 1957; Whyte, 1952; Taylor, 1955) support the accounts by Davies and Fuller. After communications between the Borough and the Department of Health in March 1952, the latter gave its approval to water fluoridation and allowed the Council to proceed. The medical officer at Palmerston North (D Taylor) corroborated that the New Zealand government agreed to finance the pilot scheme. Hewat chose the nearby city of Napier as the control and all was in place for the project. In essence, personal liaison and either public approval or apathy meant that the Council made an independent decision to fluoridate the Hastings water supply. This political, legislative and fiscal background allowed a Council decision without resort to a referendum.

With respect to community water fluoridation in New Zealand, Hastings represented the primary interface between science and politics. Moreover, protagonists demonstrated that the weight of scientific evidence could produce a favourable executive response in the political domain. However, this was the end of the “honeymoon” era of United States’ acceptance of adjusted fluoridation (Akers and Porter, 2004). In November 1953, after the Hastings plant had been in operation for about eight months, opposition emerged that coincided with the election of a new mayor and five
new councillors. This was the genesis of a New Zealand antifluoride movement, and it grew quickly.

A brief account of events at Hastings between 1954 and 1957 is worthwhile because it demonstrates the role of national political and bureaucratic resolve in maintaining community water fluoridation in New Zealand. In response to an enquiry by the new Council in March 1954, the Director-General of Health (J Cairney) advised the Hastings Borough Council that the “Municipal Corporations Act (1954) … gave them authority to do things necessary for the preservation of public health and that he ruled that fluoridation of a public water supply is for the preservation of public health” (Taylor, 1955). Several months later, the Director of the US National Institute of Dental Research (FA Arnold) and English researcher GF Parfitt visited Hastings and gave public assurances about the safety and effectiveness of community water fluoridation. Fluoridation continued. The 1956 election of articulate antifluoridationist DM Robinson (later Sir) as the Mayor of Auckland—whom Fuller later described as a “formidable opponent”—was a political setback for fluoride advocates (Fuller, 1997). Either perceiving the increasing political unease or mirroring the USPHS policy, the NZDA’s 1956 edict “Fluoridation” acknowledged the importance and desirability of community water fluoridation but continued: “The Dental Association believes that the request for fluoridation should come willingly from the public and realises that extensive dental health campaigns may be necessary to inform people of the correct facts…” (The Executive of The New Zealand Dental Association, 1956). New Zealand’s fluoride advocates now had to engage their adversaries in the public domain.

Paradoxically, developments at Hastings became vexatious; this carried obvious consequences for the future of fluoridation in New Zealand. It was a “project” or “demonstration” and problems of scientific method negated any prospective status as a field trial (Ludwig, 1958). The abandonment of the control city (Napier) because it had a lower initial caries rate than that of Hastings (Ludwig, 1958) implicated soil science as a confounding factor in New Zealand cariology (Ludwig and Healey, 1962; Ludwig, 1963). Moreover, the inappropriate original fluoridation equipment produced variations in fluoride concentrations, which disrupted the MRC’s before-and-after-fluoridation dental investigations (Ludwig, 1958). The changing of NZSDS diagnostic criteria for caries and the cessation of the NZSDS nurses’ practice of prophylactic restoration of fissures further confused interpretations. While later antifluoridationists justifiably claimed that the changed diagnostic criteria contributed to the fall in caries (Colquhoun, 1999), their “science or swindle” questioning of methodology and findings (Colquhoun and Mann, 1986; Colquhoun, 1998; Colquhoun and Wilson, 1999) simplified confounding variables and dismissed international evidence supporting community water fluoridation as one factor in declining community caries incidence (de Liefde, 1998). However, to defend the Hastings backdrop—much of which was in the public domain by 1958—presented obvious difficulties. Growing public opposition at Hastings and an injunction to stop fluoridating stalled further fluoride implementations in New Zealand. Furthermore, Hastings Borough Council decided to conduct a poll that “required central government approval” (Colquhoun and Wilson, 1999). A referendum carried significant ramifications because the pioneering background of the Hastings proposal and the emotional nature of fluoride politics impeded objective debate in the media. Moreover, the caries epidemic remained an urgent national problem. In addition, at this critical time in the formation of public opinion in New Zealand, Exner and Waldbott published their book The American Fluoridation Experiment, which questioned the methodology of the North American field trials under the catch phrase of “twenty-eight million guinea pigs” (Exner and Waldbott, 1957). This background explained the national government’s intervention with a commission to authoritatively assess community fluoridation as a public health measure.

The Commission of Inquiry
The Commission of Inquiry provided an independent forum that analysed evidence without researchers having to run the gauntlet of public meetings in municipal halls. Testimony came from 121 witnesses at five hearings located across New Zealand. Davies\(^4\) later commented: “the advantage for all parties was…equal opportunity and a respectful hearing where every one had a say.” Fluoride advocates’ arguments were detailed and predictable: epidemiology confirmed caries was a national health problem; United States’ evidence demonstrated the effectiveness and safety of artificial water fluoridation; no alternative vehicle for fluoride delivery was as successful; and preventive strategies and restorative programmes had failed in New Zealand. Bibby produced Departmental statistics on children and adolescents, and demonstrated the £1,505,996 cost (for the year ended 31 March 1956, and excluding capital expenditure) of the dental services to the government. Davies, who testified with a box of catalogued palm cards at his side, typified the meticulous approach of New Zealand’s fluoride advocates. Their case was overwhelming.

The Report of the Commission of Inquiry on the Fluoridation of Public Water Supplies remains a seminal contribution to the international dental literature. In its findings, the commissioners dismissed issues of personal liberty and strongly endorsed the safety and efficiency of artificial water fluoridation. The commissioners also found that fluoridation was feasible in New Zealand, warranted a national advisory body, and that it was legal via s298 of the “Municipal Corporations Act (1954)” and s20 of the “Health Act (1920)”. However, with respect to this last finding, there was a cryptic but important qualification: “Questions of this nature [statutory power of local authority] are entirely questions of law and are properly answered by the Courts.” The Commission endorsed local authorities as the appropriate decision makers, but added that a referendum was not the appropriate instrument for arbitration. The government distributed the report to every medical and dental practitioner and local authority in New Zealand. However, while Fuller and the Editor of the New Zealand Dental Journal claimed that the Commissioners’ findings strengthened the case for fluoridation in New Zealand, it meant little in the political domain (Editorial, 1957; Fuller, 1962). By November 1959, there had been eight successive referendum defeats for fluoridation proposals in New Zealand (Mitchell, 1960).

Lower Hutt
The autonomous fluoridation of Lower Hutt’s water supply in 1959 was another pivotal development that eventually produced ramifications in the British Commonwealth. Arnold and Parfitt’s visit to New Zealand, the commission’s findings and personal North American investigations persuaded the Mayor of Lower Hutt (P Dowse) to fluoridate that municipality’s water supply (Fuller, 1962; Fuller, \(^4\)GN Davies, personal communication, 2003.)
used some dubious methodology. For example, by comparing mayoral voting figures and referendum figures, Mitchell found an association between Labour voters and fluoride rejection. Furthermore, his “pressure group” analysis suffered from a major omission in that he made only an ephemeral reference to supporters of Social Credit, who strongly opposed community water fluoridation. Notwithstanding these criticisms, Mitchell confirmed the emerging North American trend: when it came to implementation or rejection of water fluoridation: demographic characteristics were not a strong influence.

In spite of New Zealand’s early adoption of water fluoridation, its sociological literature on the associated conflict is both scant and largely misdirected. Taylor and Mitchell understated the government’s involvement in dentistry, the culture of multidisciplinary dental research and the dental epidemiology. In this sense, their emphasis on tactics and education were peripheral because they ignored the underlying scientific and political milieu that underpinned New Zealand’s early uptake of fluoridation. Almost fifty years later, Wrapson outlined the genesis of New Zealand public health, its maturation into social policy and the rise of community water fluoridation (Wrapson, 2005). However, Wrapson’s emphasis on history meant that her dissertation contributed little to understanding of why municipalities adopt, reject, defer or ignore this public health measure. Hence, another distinctive and surprising feature in New Zealand’s contribution to the fluoride literature is political scientists’ apparent lack of interest in conflict analysis.

CONCLUSION

New Zealand’s early fluoride advocates enjoyed a fortuitous topography, demography and constitutional background, which laid the foundations for their contagious culture of multidisciplinary research and institutional liaison. To a contemporary Australian (and hence an external and retrospective observer), New Zealand’s public dental policy was visionary. This also contributed to the nation’s early penchant for community water fluoridation. Moreover, exceptional dental epidemiology and political resolve further underpinned the pre-1970 implementation of community water fluoridation. However, in spite of New Zealand’s early contribution to the international fluoride debate, a paradox exists. Although behavioural scientists and historians have intermittently examined fluoride-related controversy, the failure of political scientists to fully integrate the role of centralised political authority with the weight of scientific evidence remains a surprising inadequacy in the New Zealand literature.

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