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ARTICLE

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Research, knowledge, and policy on goitre and iodine in Norway (1850–2016)

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Abstract

Our aim is to shed light on the relationships between research, knowledge, and policy in the case of goitre and the use of iodine as a preventive measure against it in Norway from the 1850s onward. Goitre was previously widespread in certain areas of Norway, but disappeared around 1950. After many decades of silence about goitre and iodine, an expert report in 2016 argued that action should be taken to prevent iodine deficiency. Already in 1927, an international conference on goitre led to the agreement that the best preventive measure against goitre was to fortify table salt with iodine. The conference had Norwegian participants, but Norwegian health authorities did not follow the recommendations from the conference. To understand why new knowledge and recommendations did not result in new policy, we explore the history of Norwegian research on goitre and iodine, and Norwegian contributions to and the inspiration from international research in the field. Furthermore, we analyse the measures for the prevention and curing of goitre that have been implemented by authorities over time. The preventive measures introduced in Norway from the 1930s were very modest and differed from those in other countries. We argue for the importance of analysing the political context to understand the success or failure of advice given by researchers to policymakers.

KEYWORDS
iodine, goitre, knowledge and policy, nutrition policy, nutrition, Norway

1 | INTRODUCTION

In August 1927, more than 180 researchers and medical representatives from several European countries, the United States, and Japan gathered in Bern, Switzerland. They were invited by the Swiss Goitre Commission for the First International Conference on Goitre.[1] Goitre was widespread in Switzerland and many other countries, such as Norway and Sweden, and the conference was convened to discuss the causes and prevention of endemic goitre. Intervention studies in the USA and Switzerland in the late 1910s had shown that iodine supplementation could prevent goitre, and Swiss authorities had, since 1922, been implementing the addition of iodine to table salt. The conference in Bern supported the Swiss policy.[2] Three Norwegian researchers contributed to the conference, but the conference's recommendations were not followed by Norwegian health authorities. Why were the recommendations from this international research community not followed?

This question triggered our curiosity when, in 2016, an expert committee recommended that health authorities introduce measures to prevent mild and moderate iodine deficiency in Norway, including, once again, a recommendation for the iodine enrichment of table salt.[3] The expert recommendation was made by the Norwegian Nutrition Council in the wake of recent Nordic research that had documented that mild-to-moderate iodine deficiency had returned, at least in vulnerable groups such as children and pregnant women.[4] New Nordic research called attention to Norway's neighbour, Sweden, which had implemented the nationwide iodization of table salt in 1936 and continues to use it in goitre-prevention policy, thus having a better iodine situation than Norway.[5] So, it appears that the two countries chose different policies during the 1930s, and that differences between the countries still exist.

Our case study involves exploring the research and knowledge production on goitre and iodine over time, the advice given by researchers to policymakers, and the policies implemented to prevent and cure goitre. What characterises the history of Norwegian research on goitre and iodine in an international context? What relationships can be identified between science and policymaking regarding this issue over time? Why did the issue of adding iodine to table salt reappear nearly 100 years after it was first recommended by international goitre researchers?

Goitre, an enlarged thyroid gland that, if sufficiently large, results in an enlargement of the neck, has been described as far back as 2700 BCE in China. Goitres continued to be described in medical writings throughout the ages, from the ancient Ayurvedic practitioners to the Greeks of the Hippocratic era. Endemic goitre, followed by a certain proportion of the population being born as cretins (that is, physically and mentally retarded), has thus followed mankind for millennia, but is most notably prevalent in mountain valley regions and inland plains around the world.[6]

In Europe, the role of iodine in goitre was discussed from the early 1820s, when iodine was characterised as a new trace element and later found in the thyroid gland. Iodine treatment for goitre was introduced around the mid-1800s but caused poisoning. Later, it was found that the dosage levels used were toxic.[7] The history of goitre and iodine is included in Kenneth Carpenter's history of nutrition from 1785 to 1985. In addition to the problems of using too high doses of iodine to cure and prevent goitre, he underlined that the breakthrough of bacteriology in the late 1870s meant that potential insights in nutrition science regarding possible essential substances in the diet and deficiency diseases were delayed, as almost all health problems in the following decades were seen as having

[1]Kropfkommission (1928).
[2]Olesen (1933).
[3]Norwegian Nutrition Council (2016).
[4]For example, Abel, Meltzer, Aase, Torheim, & Brantsæter (2018).
[5]Nystrom et al. (2016).
[6]Zimmermann (2008).
[7]Carpenter (2005); Zimmermann (2008).

infectious causes.[8] This was the case for both goitre and scurvy. When the benefits of using iodine in preventing goitre were recognised in the late 1910s, many countries followed researchers' advice and introduced the fortification of table salt with iodine. The dosage of the fortification was important, as the previous century's experiences had revealed that too-high doses were harmful.[9]

To understand how and why new insight into certain nutrients (such as iodine) leads to the implementation of measures by the authorities to handle a problem (such as endemic goitre), we must explore the relationships between knowledge and policy, as new knowledge will not automatically lead to new policy. Using their broad history of nutrition science, Kamminga and Cunningham highlighted that nutrition has a political character, as nutrition and food challenges are connected to policy issues.[10] They pointed to chemistry and physiology as the roots of nutrition science. Nutrition can also be said to have roots in the discipline of hygiene or public health.[11] Public health perspectives on nutrition issues are more likely to include social and political aspects.

The path from research and scientific advice to policy implementation is, of course, not (always) straightforward. Several conditions may influence whether a policy measure recommended by a scientific community will be accepted by authorities and implemented. If the recommendation is contested, the likelihood of implementation is reduced, as Kamminga and Cunningham pointed out.[12] There were conflicting conceptions of the nature of illnesses such as goitre and scurvy, which delayed understanding of the problem and thus the implementation of preventive measures.[13] The implementation of policy measures is further likely to depend on the current state of the relevant health problems. If the recommendation addresses a serious and widespread problem, one can assume that the authorities will be more likely to implement a policy than if the problem affects only a few people or certain sub-groups of the population.

The problem of goitre may have been considered minor in some countries, whereas authorities in areas with a significant problem would have been more likely to implement action. This was the case in Switzerland, which in 1922 established a goitre commission to take public health action against a widespread problem.[14] Further, a prevention strategy to handle a specific problem may go against the interests of important stakeholders. This has been the case in many countries aiming to reduce the population's intake of fats, where agricultural interests have argued against campaigns to reduce the intake of certain foods, such as butter in New Zealand or conflicting nutritional and agricultural policy goals related to the intake of fat, and butter, in Norway in the 1970s.[15] In addition, commercial interests, such as the pharmaceutical industry, may have an interest in the production of vitamins or minerals and will thus argue against fortification as a general measure.[16] Some disciplines or research institutions, like the public health institutes established in the early 1900s, might also have closer relationships with the authorities than others.[17] Lastly, recommendations from some research institutions or researchers may have less credibility than others due to historical or political circumstances. Different countries, after scientific advances, may or may not implement certain measures, depending on their particular political and/or societal situations. As we will show later, this was certainly the case for Norway.

In this article, we shed light on such conditions in one case—the response to the problem of goitre during a specific period and in a specific country—to discuss conditions that more generally influence the path of knowledge from science to policy. To do so, we explore the research and expert knowledge about this issue that has accrued over time and search for relationships between research and policy. Our aim is to contribute to the understanding of

[8]Carpenter (2003a).
[9]Carpenter (2003b; 2005).
[10]Kamminga & Cunningham (1995).
[11]Elvbakken (2020).
[12]Kamminga & Cunningham (1995).
[13]Carpenter (2003a).
[14]Quervain (1927).
[15]Steel (2005), Kjærnes (1994; 2003).
[16]Sogner (1997).
[17]Barona (2019); Elvbakken & Ludvigsen (2016).

which conditions have the potential to influence policymaking in a certain public health field, conditions that may hinder or facilitate the use of new knowledge.

Our material includes two Norwegian medical journals: *Norsk Magasin for Lægevidenskapen* (*NML*; 1850–1939) and *Tidsskrift for Den norske Lægeforening* (*TfNL*; 1881–1960). These journals contain original research papers, reviews, summaries of articles published in international journals, and notes on conferences and meetings.[18] We also mapped contributions about iodine, goitre, and cretinism from university research published in the Annual Reports from the Norwegian University of Oslo (UiO).[19] Additionally, printed volumes from four International Conferences on Goitre were studied. The first (1927) and second (1933) were held in Bern, the third in Washington, DC (1938), and the fourth in London (1960).[20] We examined policy regulations from medical and agricultural authorities regarding iodine in salt and animal fodder that were published in official registers of regulations, official statistics, and material at the Norwegian National Archives.[21] We searched three Norwegian newspapers, *Aftenposten*, *Nationen* and *Tidens Tegn*, for articles about goitre and iodine. *Aftenposten* was and is Norway's largest newspaper.[22] Between 1920 and 1955, these papers regularly featured news stories about goitre and iodine. We hardly found any articles on the topic in the preceding or following years.

Based on these sources, we identified three periods of goitre-iodine research in Norway from the 1800s to the present. The first period covers the period between 1850 and 1920, the second from 1920 to 1950, and the third from 1950 until 2010. In the first period, research on goitre and iodine was established. The second period was a very active period in goitre research, and Norwegian researchers played an active role in the international goitre and iodine research community. During the third period, after World War II, research and discussions regarding goitre and iodine almost disappeared. The revived interest in iodine and goitre and the proposals for new action from the Norwegian expert committee in 2016 marks an end to the quiet years of the third period. For each period, we examine Norwegian goitre-iodine research, contributions to the international research community, policy proposals by researchers, and the eventual measures implemented by health authorities.

2 | DISCUSSIONS ABOUT GOITRE AETIOLOGY AND PREVALENCE UNTIL 1920

Both internationally and in Norway, goitre was recognised as being a problem in certain areas, and the role of iodine as a cure and preventive measure was discussed from the mid-1800s, although there was still uncertainty about the problem's causes.

The physician Christian August Egeberg (1809–1874) was the first to write about goitre in the Norwegian language.[23] In 1855, Egeberg proposed the establishment of a commission to study the prevalence of goitre. He referred to international literature and argued that goitre was less prevalent in Norway than in Switzerland: "This disease occurs less often here, where deep fjords everywhere lead the snow and its atmosphere to the foot of our mountains and where ocean fish and their conservation products are consumed all year round."[24] Egeberg was an entrepreneur in medical statistics and epidemiology as well as a recognised and successful surgeon; however, the goitre commission he suggested was never established.[25] To establish a goitre commission would require the public health authorities to take action. Only much later, in 1922, did Switzerland appoint a goitre commission.

[18]*NML* was published by the Norwegian Medical Society between 1840 and 1939. *TfNL* was initially published by the Norwegian Association of Physicians in 1881 and is still going strong. From 1881 to 1889 it was titled *Tidsskrift for Praktisk Medisin*.

[19]The University Annual Reports (AR) are dating from the 1880s to the 1950s from the Faculty of Medicine at the University of Oslo (UiO). The university was named the Kongelige Frederiks Universitet from its establishment in 1811 until 1938, when the university got its current name, UiO. Until roughly 1950, the annual reports from each lecturer on their lectures as well as publications and reports from each department were included in these volumes.

[20]Kropfkommission (1928); Stiner (1933); Coller et al (eds) (1938); Pitt-Rivers (1961) 1960.

[21]The archives of the Ministry of Social Affairs and its Directorate of Medicine, in the Riksarkivet (RA; the Norwegian National Archives).

[22]The newspaper articles will be referred to with the date and page of each article if cited specifically.

[23]Nicolaysen (1933).

[24]Nicolaysen (1933, p. 89). Our translation.

[25]Larsen (2009).

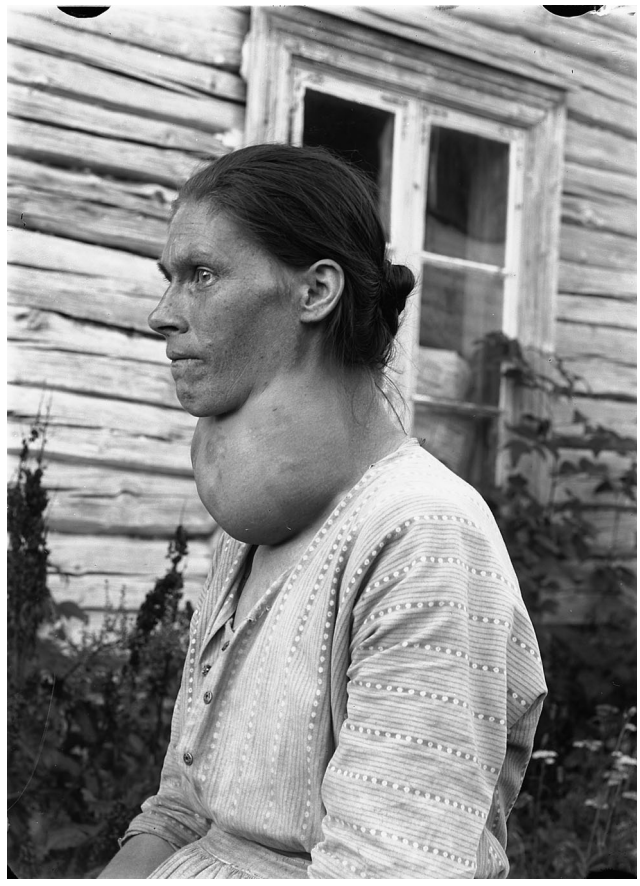

FIGURE 1 The photo is taken around 1910 and shows Mina Petersdatter Lundstein, born in the goitre district Nes in Hedmark county in 1885. From Digitaltmuseum – Photo Martin Finborud – Anno Domkirkeodden

The production of medical statistics was another public health strategy.[26] From the 1820s, medical statistics in Norway were collected from state-employed district physicians as one of their obligations, which were formalised in the Norwegian public health legislation of 1860.[27] However, the reports varied from municipality to municipality, as the standards for reporting were vague during the first few decades. Goitre, and sometimes goitre surgeries, were reported in official medical statistics, but not systematically; for example, the records indicate 16 goitre surgeries in 1868, and one in 1877. Surgery was used as a treatment to make respiration easier and was performed in Norway from the 1860s.[28] Many instances of iodine injection are reported, and goitre is reported to have been a common problem in a number of places (Figure 1).[29]

There was some academic interest in goitre, particularly in its aetiology, but not from university departments with close connections to nutrition and public health policy. The physician Hans J. Vetlesen (1852–1926) presented the first doctoral thesis on goitre in 1877, "Ætheologiske Studier over Struma" (Aetiological Studies on Goitre).[30] Two years later, Axel Johannessen (1849–1926) discussed the aetiology of goitre in one of his doctoral lectures.[31] Johannessen gave an overview of the international discussion of goitre's causes before deeply analysing the most likely theory of the time, that goitre is caused by poor-quality drinking water that is contaminated or has an

[26]Porter (1999).
[27]Moseng (2003).
[28]Nicolaysen (1933).
[29]For example, Statistics Norway (1868; 1877).
[30]Vetlesen (1887); see the list of all doctoral theses from the Faculty of Medicine, UiO, 1817–2014, in Larsen (2014).
[31]Johannessen (1889).

unbalanced ratio of minerals. He discussed in detail the geological conditions in areas where goitre is and is not prevalent, and described its prevalence in areas surrounding inland Norway's Lake Mjøsa.

Nutrition education for medical students and nutrition-related research were on the agenda at the Departments of Physiology and Hygiene at the only Norwegian university in the late 1800s, but neither department approached the issue of goitre or iodine.[32] The professor of hygiene Axel Holst researched nutrition and vitamins from 1892 to 1930, but not goitre or iodine.[33] Axel Holst and his co-author, Theodor Frölich, published an article on the causes of scurvy.[34] As mentioned, Carpenter pointed to controversies on the causes of goitre, as there was a tendency to view all diseases as being infectious; this tendency arose during a time of great optimism following the bacteriology breakthrough in the late 1880s.[35] Around 1908 in Norway, such a controversy regarding the causes of scurvy can be seen, involving Axel Holst and professor of physiology Sofus Torup.[36] However, neither Holst nor Torup engaged in debate on the goitre-iodine issue, and accordingly such a conflict did not arise concerning goitre.

The goitre-iodine issue was, however, of interest to research-oriented district physicians in the years before 1920. In 1913, the district physician in Nes (near the town of Hamar), Carl Schiøtz (1877–1938), published an overview of the "goitre issue" in *NML*. He addressed the high prevalence of goitre among schoolchildren in the inland lake area where he was working.[37] In 1917, he gave his doctoral lecture on goitre.[38] This printed lecture has several illustrations, including of children with cretinism. Another district physician, Sverre Kjølstad (1889–1957), also served as a physician in Nes from 1914. He reported on his goitre patients, focusing on the treatment he provided and his thoughts after having studied the international literature on this topic.[39] Furthermore, Kjølstad detailed the goitre situation in the county of Telemark and discussed the use of iodine for curing and preventing endemic goitre.[40] He later became the chief medical officer in the county of Buskerud, and continued to take an interest in the goitre issue. Kjølstad argued for the benefits of adding iodine to salt, but no public health action was taken by health authorities.

Norwegian physicians were introduced to the ongoing international discussions about goitre and iodine through small abstracts in medical journals. The strategy of treating goitre with iodine was described by Lücke in Bern and was reported in *NML*.[41] Furthermore, this treatment was described in the Norwegian Medical Society in 1882.[42] Some additional writings on goitre appeared in medical journals during this period, such as Bendix Ebbell's articles. Ebbell (1865–1941) was a Norwegian missionary and physician in Madagascar; while there, he wrote several articles on the aetiology of goitre.[43] He also discussed the role of substances in drinking water that might have been causing goitre. A manuscript by physician Claudius Lucien Dedichen (1867–1944) on different categories of goitre was awarded the Professor Skjelderups Gold Medal in 1912, and thus became known to the public.[44]

The more general nutrition-policy context in these years was to a considerable extent related to the rationing of food, and more specifically of fats, that was implemented during WWI. This rationing lasted until the early 1920s.[45] The Norwegian state was still young, and the state administration was small. However, on many issues, the state relied on scientific expertise from the university, as it had done with the rationing of fats. This was not the case concerning goitre.

[32]The discipline of hygiene was also named state medicine or politica medica, and could be named public health (Elvbakken, 2020).
[33]Elvbakken (2020).
[34]A. Holst & Frölich (1907).
[35]Carpenter (2003a).
[36]Asdal (2014).
[37]Schiøtz (1913).
[38]Schiøtz (1917).
[39]Kjølstad (1918).
[40]Kjølstad (1921).
[41]Thilesen (1868).
[42]Nicolaysen (1933).
[43]For example, Ebbell (1910).
[44]Aftenposten, 1912, 02.09. p. 3.
[45]Elvbakken & Lykknes (2017).

3 | RESEARCH-BASED CONSENSUS BUT WEAK PUBLIC HEALTH ACTION (1920S–1950)

In general, nutrition, from the 1920s, was on the political agendas of many countries. This was linked to the difficult economic situation and the problems of malnutrition among the poor population.[46] The main issues concerned the supply of enough good-quality food and the securing of sufficient intake, especially among the poor. The League of Nations raised the issue of nutrition and argued for increased agricultural production and more robust state intervention to handle the problem of nutrition.[47] However, goitre and iodine were not of specific interest to the League of Nations. In some countries, the problem of goitre affected their economic and military capacities so severely that action had to be taken, like in Switzerland, where the aforementioned Goitre Commission was established in 1922.[48] Between the 1920s and 1950 were the years Carpenter characterised as the vitamin era (1912–1945) in his articles about the history of nutrition science, as several vitamins were identified during this time.[49] As for the prevention and treatment of goitre, the role of iodine was no longer contested. What happened in Norwegian goitre-iodine research and policy in these years?

3.1 | International contributions by Norwegians

From the mid-1920s until World War II, Norwegian researchers entered the international goitre-iodine scientific scene. Three international conferences on goitre were held, in 1927, 1933, and 1938. The first and second conferences were held in Bern and arranged by the Swiss Goitre Commission, a public health body established by the authorities to combat the high prevalence of goitre in Switzerland.[50] The lectures and discussions held during the two Bern conferences, as well the third in Washington, are reported comprehensively in three printed volumes.[51] The conferences were announced and referred to in numerous medical journals, including *The Lancet*, the *British Medical Journal*, and *Klinische Wochenschrift*. The conference reports provide an interesting overview of the contemporary state of knowledge, as well as some controversies concerning the pathology, aetiology, and epidemiology of goitre (Figure 2).

Three Norwegian researchers participated in the 1927 conference, four in 1933, and none in 1938. Strikingly, in 1927, two of them were surgeons and the third a chemist; one of the surgeons and the chemist were present in 1933, and they presented papers at both conferences. The two surgeons were professors Johan Nicolaysen (1860–1944) and Johan M. Holst (1892–1953). The chemist was Gulbrand Lunde (1901–1942). From 1926, he was engaged in goitre-iodine research at the University of Oslo and cooperated and published with Holst, among others. In 1930, he became the first director of the new state-funded laboratory for the Norwegian canning industry in Stavanger.[52] The Norwegian contribution did not come from the nutrition-oriented disciplines of hygiene and physiology, but from the clinical discipline of surgery and from chemistry.

In 1925, the most senior Norwegian participant in Bern, Johan Nicolaysen, brought the international knowledge of goitre and iodine to the Norwegian medical community through an article in *TfNL*.[53] He addressed the positive effects of iodine on goitre and the various successes and failures regarding the use of iodine to prevent and cure goitre from the 1850s onwards. He offered detailed information about the dose-response experiments performed in

[46]Barona (2008; 2012); Haave (1990); Kjærnes (1994); Elvbakken (2020).
[47]League of Nations (1936).
[48]Olesen (1933).
[49]Carpenter (2003b).
[50]Olesen (1933).
[51]Kropfkommission (1928); Stiner (1933); Coller, Yung, & Mosser (1938).
[52]Lunde was educated at the Technical University in Zürich and attained a doctoral degree from Freiburg in 1925. In 1927, he was engaged in research focusing the goitre-iodine issues at the University of Oslo, and he cooperated and published with Johan L. Holst, among others. In 1933, he became a member of the Norwegian Nazi party.
[53]Nicolaysen (1925).

FIGURE 2 Front page of the printed report from the first international conference on goitre in Bern, Switzerland, 1927

Switzerland in 1918, and about the 1919 article written by American physicians Marine and Kimball, who had presented their results from a large intervention experiment in Ohio, in which iodine was used as a means to prevent goitre.[54] Nicolaysen warned that a "wild" use of iodine was dangerous, but that no harm and positive outcomes were reported with the controlled use of iodine among schoolchildren.[55]

How did the Norwegian researchers contribute at the 1927 and 1933 Bern conferences? From the conference books, we will highlight three contributions.[56]

First, Lunde presented a study about the iodine status in Norwegians and the role of their intake of white saltwater fish.[57] The study was the result of cooperation with Nicolaysen. Lunde discussed the association between fish intake and iodine excretion and presented analyses of the iodine in fish and fish products; he argued that increasing the consumption of white fish and fish products would hinder the development of goitre. This paper was recognised as interesting by French physician de Quervain in his report of the conference.[58] The second contribution was Nicolaysen's and Lunde's argument on the positive effect of milk intake when iodine was added to cow fodder; the addition of iodine did not have any negative effect on the milk. Lunde stated that this would be a positive means to prevent goitre. De Quervain also mentioned this contribution. The third contribution, by Johan M. Holst, was about

[54]Bürgi, Supersaxo, & Selz (1990); Carpenter (2005).
[55]Nicolaysen (1925, p. 585).
[56]Kropfkommission (1928); Stiner (1933).
[57]Lunde (1927); Kropfkommission (1928).
[58]Quervain (1927, p. 1241).

the treatment of goitre. Professor W. His in Berlin, when reporting on the Bern conference, mentioned Johan Holst's studies.[59]

Both Holst and Lunde continued to contribute to international goitre-iodine research after the first Bern conference. Holst's contribution to the discussions about the treatment of goitre as an illness of iodine deficiency was recognised by German physician Hellwig, who discussed Holst's writing on goitre.[60] In 1931, Holst published an article about iodine treatment and abuse in Basedow, which was reported by the Medical Society in Oslo.[61] At the 1933 Bern conference, Holst presented a full paper on the pathological anatomy of the goitre organs in Basedow, and actively participated in discussions.[62]

In 1928, Gulbrand Lunde visited several universities in the United States. He presented papers at the annual meeting of the American Association for the Study of Goitre in Denver.[63] Lunde also published on the occurrence of iodine in Norwegian soil and food as well as on iodine occurrence and goitre prophylaxis.[64] He reported that iodine content differs between species of fish, with haddock and cod having the highest content, and that some parts of the fish had a higher iodine content than others. Furthermore, Lunde analysed the iodine content in human urine, finding that this differed from region to region, with more iodine in urine samples from Bergen than from Oslo. This indicated a higher intake of iodine from the diet in Bergen, a city on the west coast that in those days was characterised by diets with high intakes of fish. Lunde discussed the use of iodised salt, iodine tablets, iodised cow fodder, and fishmeal when feeding animals. He advocated the use of fishmeal in animal feed and expressed positive expectations for that strategy; surplus iodine could then transfer to the milk consumed by humans. He underlined the positive effects of including saltwater whitefish in the diet, as he had documented that these fish have high iodine levels. The export of fish was (and remains) very important to Norway. In inland areas, however, the consumption of white saltwater fish could be very rare, if they were eaten at all. Later, Lunde also published on the effect of feeding cows with kelp on the iodine content of milk and dairy products.[65] In 1933, at the second goitre conference in Bern, he presented a paper on the situation in Veitastrond, a small village on the west coast of Norway with endemic goitre.[66]

Of the four Norwegian researchers at the second conference in 1933, only Holst and Lunde presented their research. A Swedish physician, Axel Höjer (1890–1974), also participated in this conference. As a docent of hygiene at the University of Lund, Højer had previously published on iodine and goitre.[67] Höjer combined data on the prevalence of goitre and cretinism with discussions on environmental factors and nutrition. Unlike the Norwegian participants, Höjer was working within the policy-related discipline of hygiene, as were several others present, according to the list of participants.[68]

In 1924, Austria had implemented the fortification of salt with iodine and had experienced a reduction in goitre levels among schoolchildren and no increase in Basedow. The first Bern conference agreed on the prophylactic approach of adding iodine to table salt as a policy measure, coupled with the supplementation of cow fodder with iodine.[69] The organiser, the Swiss Goitre Commission, received international scientific support for the practise of adding iodine to salt. The Swiss initiative and the country's goitre commission can be seen as a state–science alliance. Switzerland was strongly affected by goitre, and these initiatives must be understood as a public health strategy. In the history of public health, conferences that involve delegates from state policymakers coming together with

[59]His (1927, p. 1914).
[60]Hellwig (1930). Johan Holst later wrote a comment to Hellwig adding some information about his contribution (Holst 1931b).
[61]J. Holst (1931a). Basedow, today often called Graves disease, is an autoimmune disease that affects the thyroid, and frequently results in and is the most common cause of hyperthyroidism, followed by an enlarged thyroid.
[62]Stiner (1933, p. 320).
[63]J. Holst & Lunde (1928); Lunde (1928); J. Holst, Lunde, Closs, & Pedersen (1928).
[64]Lunde, Closs, & Bøe (1929); Lunde (1930).
[65]Lunde & Closs (1936).
[66]Lunde (1933); Iversen, Lunde, & Wülfert (1930).
[67]That is, Höjer (1929).
[68]Stiner (1933).
[69]Quervain (1927).

scientific bodies to discuss problems and prevention strategies have been a mutually important means of support and inspiration.[70]

In 1938, the Third International Goitre Conference was held in Washington, DC. More than 300 participants gathered for the event, but none were from Norway or Sweden. The conference was no longer arranged by health authorities but rather by the American Thyroid Society. It was merely an ordinary scientific conference where American participants outnumbered the Europeans.[71] Judging by the agenda, the goitre issue shifted its focus from a public health perspective towards a more biochemical one, which may reflect scientific progress and new research methods. Surgery was no longer as important as before, while thyroid and biochemical research received more attention. However, the conference was unanimous regarding the necessity of adding iodine to salt as an important and effective prophylactic strategy.

3.2 | Policymaking on goitre and iodine

The Bern conferences took place during a period when the League of Nations was putting nutrition and nutrition policy on its agenda.[72] The League and many member-countries engaged with nutrition issues, mainly concerning combating malnutrition. Vitamin research was emphasised, giving new insight into the relationship between health and nutrition. However, as mentioned earlier, the League did not engage with the question of goitre and iodine.

The international agreement about the benefits of adding iodine to salt that emerged from the Bern conferences in 1927 and 1933 did not lead to an implementation of this strategy throughout Norway. We have not found any discussions about this strategy by nutrition-oriented researchers in the disciplines of physiology and hygiene.[73] Goitre and iodine issues were peripheral topics in lectures by professors of physiology, as seen in one textbook first published in 1929 and reprinted many times. The goitre-iodine issue was mentioned but not outlined.[74] As mentioned, Carl Schiøtz, professor of hygiene from 1931–1938, had written an article on goitre in 1913, and he gave his doctoral lecture on goitre in 1917. Food and nutrition were among his later research issues, but they did not include goitre or iodine. He wrote a textbook on hygiene for medical students in 1937. The textbook mentioned various works regarding the prevalence of goitre by district physician Kjølstad, and Schiøtz referred to the benefits of increasing one's fish consumption but not to the benefits of adding iodine to salt.[75] The recommendations from the 1927 and 1933 Bern conferences and from Norwegian surgeons and chemists were thus ignored in these textbooks.

The newspaper *Aftenposten* regularly reported on iodine and goitre, with articles such as interviews with iodine researchers or summaries from scientific meetings. Throughout 1927 and 1928, Lunde and his work on iodine was regularly mentioned.[76] Most articles emphasised the consumption of saltwater fish, with the white fishes cod, saithe, and haddock advanced as the best sources of iodine. The articles underlined that the prevalence of goitre was much higher in Switzerland and Austria than in Norway, and discussed both countries as potential areas for Norway to export its fish.[77] In 1928, Lunde's work on the iodine content of Norwegian saltwater fish was awarded a silver medal by the Society for the Promotion of Norwegian Fisheries. His results were clearly of interest to the fishery industry and to the authorities, as the society was supported by the Ministry of Trade and Industry.

However, in the inland districts of Norway with endemic goitre, local public health authorities implemented measures to combat the problem. The aforementioned Sverre Kjølstad, formerly a district physician and now a county physician, was among those who took the initiative to introduce iodine supplementation. In 1928 and 1929, tablets

[70]Rosen (1993); Porter (1999); Roemer (1994).
[71]Coller et al. (1938). Of the 61 printed papers, 41 were by American authors.
[72]Barona (2012).
[73]Elvbakken (2020).
[74]Langfeldt (1936).
[75]Schiøtz (1937).
[76]For example, Aftenposten, 1928, 24.04.
[77]Aftenposten, 1928, 24.04.

containing iodine were given to schoolchildren in Modum, a municipality some 70 km west of Oslo that was known for its high prevalence of goitre. From 1932 to 1937, similar tablets were given to schoolchildren in the neighbouring valleys of Sigdal and Eggedal. In addition, a large goitre survey was conducted in Modum that included a thorough investigation of some 4,300 inhabitants of both sexes and of all ages. The results, published in 1937, documented a shocking prevalence of goitre in Modum, up to 80% among schoolchildren as well as high percentages among women of childbearing age. The survey found that the more children a woman had, the higher her risk of developing goitre.[78]

The article discussed how to deal with this crippling health condition. It strongly advised the iodisation of household salt at concentrations of 5 μg/g, arguing that this level was safe and sufficient for preventing goitre in the young. The article suggested that iodised salt should be referred to as *Østlandssalt* (Eastern-Norway salt) and that it should be available for sale in all of eastern Norway. The recommended long-term strategy was to increase the consumption of white saltwater fish. It claimed, however, that this was unrealistic as an immediate measure, as it would be difficult to suddenly increase saltwater fish consumption. This discussion reflects the scholarly debate of the previous decade, which encouraged inland households to increase their consumption of saltwater fish.

In 1938, a special table salt called *Østlandssalt* was introduced in the eastern part of Norway. It seems that the 1937 article in the *NML* by local doctors, who documented the severity of goitre in some age groups in the districts of Modum and Sigdal, altered the discourse.[79] This article was followed by scientific discussions.[80] The new availability of iodised throughout eastern Norway in June 1938 appears to have been the result of actions taken by these local doctors, although the production of this special table salt was approved by the Ministry of Social Affairs.[81] In June 1938, roughly 20 local newspapers in eastern Norway published articles about iodised salt, claiming that it should be the preferred salt in all households. One newspaper stated that 160,000 leaflets about iodised salt had been printed for distribution to schoolchildren, who were to take them home to their family members.[82] This indicates that health authorities had conducted a public awareness campaign, although we have been unable to find confirmation of this. The central health authorities seem to have been rather passive when it came to implementing the addition of iodine to salt. This was a local action, implemented on the basis of local public health initiatives.

The situation was different in Sweden. The Swedish Director of Health, Axel Højer, appointed in 1935, had participated in the Bern conference in 1933 and had conducted research on goitre and iodine.[83] In 1936, he argued for the addition of iodine to salt throughout Sweden, and he was heard: iodine was added to the table salt. The concentration of iodine in the Swedish table salt was 10 times higher than in the Norwegian Østlandssalt.[84] Höjer, who had a background in the discipline of hygiene at Lund University when he was appointed to the leading position in the central health administration, was put in a position that allowed him to act. In Norway, researchers in surgery and chemistry were in a different position, as they were not close to the health authorities. County-level physicians Devold and Kjølstad could promote local actions, but nobody at the central-state level seemed to argue for action.

In the early 1930s, Norway had political discussions and conflicts over nutrition policy. The conflicts, as in many other countries, were about support for poor families. Whereas experts from physiology in Norway and in other countries calculated the so-called minimum diet, socialists and hygiene experts argued for giving the poor financial support to make it possible for them to eat both healthily and enough.[85] In Norway, the Medical Society was deeply divided, and the conflict was strongly political. When the labour party formed the government in 1935, nutrition

[78]Devold, Batt, Closs, & Backer (1937).
[79]Devold et al. (1937).
[80]Batt (1938).
[81]In 1937, a new Norwegian regulation was established stating that salt intended for humans could contain up to 1 g of KI (potassium iodide) per 150 kg of salt (equivalent to 5 μg of iodine per 1 g of salt), and that salt intended for animal consumption could contain up to 0.15% KI (equivalent to 1,500 μg of iodine per 1 g of salt): Norsk Lovtiend (1937).
[82]*Tidens Tegn*, 1938, 08.06, p.1, 10.
[83]Höjer (1929).
[84]Nystrom et al. (2016).
[85]Barona (2012); Cullather (2007); Elvbakken (2020).

policy was given priority in combination with agricultural policy.[86] Following recommendations from the League of Nations, Norwegian authorities established a National Nutrition Council in 1937. Carl Schiøtz was the chair and physician Karl Evang (1902–1981) the secretary. This council was only active for 1 year, however, as Schiøtz died in 1938. The Council did not engage with the goitre-iodine issue.

In 1939, the Norwegian health authorities, under new Director of Health Karl Evang, appointed a commission comprised of representatives from many ministries, organisations, and university and research institutions, with Evang as the chairperson, to secure the food supply all over Norway and to handle nutrition issues in the case of crisis and a possible war. The commission published reports and gave advice to the population.[87] Ragnar Nicolaysen (1902–1986), professor of nutrition at the University of Oslo from 1940 to 1972, had only a small comment on the goitre-iodine issue in his chapter. He referred to the benefits of increasing the intake of saltwater fish in areas where goitre occurred, but he did not mention the use of iodised salt.[88] The findings and literature produced by Lunde were not mentioned.

During World War II, food in Norway was rationed, and the Nazi party authorities under the occupation used propaganda, such as radio speeches, to promote the best nutrition possible during times of restricted food supply. Among other information, the intake of white saltwater fish was emphasised as a source pf iodine to prevent goitre.[89] The speeches on the radio argued for the use of iodised salt as well as the increased intake of saltwater white fish. The chemist and iodine expert, Lunde, was Norway's Nazi minister for culture and propaganda from 1940 until his death in 1942.[90] His many analyses of iodine in Norwegian foods are prominent in a 1945 food composition publication.[91] Since Lunde was the Nazi minister for propaganda, it is possible that he was behind the radio speeches on food and nutrition, but we have not been able to confirm this. There were a few goitre-related scientific publications in Norway during the war. One of these was a doctoral thesis based on data from Valle in Sætesdal, which is described as a rather inaccessible valley with limited external contact. The prevalence of goitre in Valle was especially high in women who had given birth, where 53% of women in their 30s had goitre in the late 1930s.[92]

Norwegian researchers from the fields of surgery and chemistry who participated in the international goitre-iodine scene from the mid-1920s until the mid-1930s contributed to the discussions on the causes of goitre and means of prevention. These contributions were acknowledged internationally as arguments for increasing saltwater fish consumption. Also, the adding of iodine to table salt and animal fodder, especially to milk-producing animals, was widely recommended. However, these questions were not the focus of discussions on nutrition problems linked to poverty and unemployment. Public health researchers were not deeply interested in the goitre-iodine question in Norway, in contrast to the situation in Sweden.

4 | THE QUIET YEARS (1950–2010)

A quiet period of several decades began in the 1950s. Research and public discourse on goitre and iodine almost completely disappeared until 2010. Following the Second World War, goitre received scant attention. Publications on goitre and iodine in the first years after the war were related to goitre in animals, especially sheep.[93] However, from a 1946 letter from a local organisation of farmer's wives in one Norwegian municipality to the Ministry of Social

[86]Haave (1990).
[87]Statens kostholdsnemnd (1940).
[88]Nicolaysen (1940).
[89]Høygaard (1941).
[90]Arntsen & Harestad (2012).
[91]Schulerud, Kanter, & Rasmussen (1945).
[92]Høye (1941).
[93]For example, Batt (1940).

Affairs, it appears that goitre was still present among the population in that community. The letter begs for iodised salt to be made available once again and pities the young girls whose large necks render them unattractive.[94]

The mandatory fortification of cow fodder with iodine from the early 1950s onwards was likely the solution to the Norwegian goitre problem. Surplus iodine spilled into the milk and, as Norway was a milk-drinking nation in those days, goitre fell into the shadows. We found one textbook from 1956 that briefly mentioned goitre that still existed in some of Norway's inland districts.[95] Other authoritative textbooks or information notes mentioned iodine deficiency and goitre in general terms, but did not say that it was an acute problem.[96] The publications by Lunde and others from the 1930s were not mentioned. We cannot rule out that goitre still existed, but it seems to have become "invisible," as no one took any interest in it or studied it anymore. Milk had become an important iodine source, and as long as milk consumption was high, the goitre problem seemed to have been solved. When a few studies on iodine status in Norway reappeared in the late 1960s and 1970s, new researchers paid minimal attention to the research and recommendations of the 1920s and 1930s, as the population was regarded as iodine replete.

In the decades following World War II, there were no articles about goitre and iodine in Norwegian medical journals. After Lunde's death in 1942, his former co-authors seem to have left this field of research. Medical textbooks, such as Langfeldt's physiology textbook and Schiøtz's hygiene textbook from the 1930s, were used until the 1970s.[97] Both textbooks had the same few sentences on goitre and iodine, but made no reference to the benefits of increased saltwater fish consumption or iodine-rich milk. Fish consumption was promoted for reasons other than goitre prevention. Neither textbook mentioned the benefits of using iodised salt.

In 1946, the Nutrition Council was re-established and strengthened with members from several ministries and academia. Representatives from the Agricultural College and the Ministry of Agriculture were given important roles.[98] The council was now headed by Karl Evang, who was Director of Health from 1938 until 1972. The Council's annual reports do not provide any indications of goitre-iodine discussions. Evang was an active participant in the formation of the World Health Organization (WHO) prior to the end of World War II. He was also involved in the establishment of the Food and Agricultural Organization (FAO) and actively promoted nutrition policy and a secure food supply.[99] However, he did not write or speak about goitre or iodine.

What about the international situation? An international WHO conference on goitre was held in London in 1952. Issues were raised regarding iodine and goitre, including discussion from a global perspective that focused on the situation of goitre and iodine in each region of the world.[100] An overview of the global goitre situation was later published.[101] From then on, the WHO regularly published overviews of the goitre situation and recommended measures to improve the situation. In August 1960, the Fourth International Conference on Goitre was held in London.[102] The number of participants rose to 600, and 100 papers were presented. The conference was arranged by the Thyroid Society. Like in Washington in 1938, attendance from representatives of health authorities was lacking. The conference was again dominated by the United States, both in terms of the participants and the papers presented. No Norwegian or Swedish researchers participated. More than 500 endocrinologists, clinicians, and biochemists participated, and 100 papers were presented. The role of surgeons had changed, apparently due to medicine's increased specialisation and the fact that surgery was no longer the dominant treatment for goitre. A report from the conference in the journal *Nature* underlined that, although striking advances in both knowledge and technique had been made since the first goitre conference was held in 1927, it was apparent that many fundamental

[94]Husholdningssalt med jodtilsetning (1948), Note to the Director of Health, from the Department of Hygiene, (H5) Jnr.4866/48/H.5, HH/EG. (4.10). Riksarkivet - National Archive, Sosialdepartementet, Hygienekontoret, H5, L0127, 0002- RA/S-2305D/Db/L0051/002Ernæring, vitaminer og vitaminisering, S-1287 -Jodert salt.
[95]Nicolaysen et al. (1956).
[96]Øgrim (1955; 1965).
[97]Langfeldt (1936); Schiøtz (1937).
[98]Kjærnes (1994; 2003).
[99]Nordby (1989).
[100]Stanburry (1953).
[101]Kelly & Snedden (1958).
[102]Pitt-Rivers (1961) 1960.

problems remained unsolved.[103] Later in 1965, the goitre conferences were renamed as International Thyroid Conferences. As with the third and fourth international conferences, the fifth was a purely scientific conference, in contrast to the combined emphasis on science and public health policy in Bern in 1927 and 1933.

The goitre conferences in Bern and the Norwegian contributions to the international scientific community were not mentioned in new articles on goitre and iodine in the 1970s. In the early 1970s, a Norwegian epidemiological study was conducted to map iodine concentrations in urine.[104] The authors concluded that iodine deficiency was no longer a health problem in Norway. A later investigation in the 1970s examined the thyroid function of 1,418 children in Modum, and measured urinary levels of iodine.[105] This paper concluded that endemic goitre no longer existed in Modum, a part of the former goitre district, and that the iodine supply was satisfactory. Another article published in the early 1970s was conducted by Norway's Military Research Institute in the wake of the atomic bomb trials conducted by the Soviet Union. It presented analyses of milk samples from all over the country and found higher levels of iodine than in the majority of European countries.[106] The same Institute investigated the impact of iodised salt on concentrations of iodine in urine and found no difference, concluding that the iodine concentration of salt was too low to have an impact on the status of iodine.[107]

After many years of silence about the goitre-iodine issue, a late 1980s study from the neighbouring country of Denmark brought this issue back to the agenda. Danish physicians had discovered that approximately 10% of elderly Danish women had visible goitres.[108] Mandatory use of iodised salt in the baking industry was imposed by the Danish authorities from 1998 onwards. Additionally, in western Norway, old goitre-related problems recieved new attention, as two small studies in the 1990s reported that people with fish and/or milk allergies might be at risk of iodine deficiency, but goitre was not investigated.[109]

A 2008 publication from the large Norwegian Mother, Father, and Child Cohort Study was a game-changer for Norwegian scientific awareness about the national iodine situation.[110] This study revealed that 80% of participating women had an iodine intake below recommended levels. Reduced milk consumption is seen as a major factor in the present situation, together with low intake of white fish and the low dosage of iodine added to table salt. The 2010s provided some more publications on the iodine issue in Norway, followed by the expert report that motivated our study.[111] Four years later in May 2020, an expert risk-benefit analysis of iodine fortification needs was published.[112] The conclusion from the Norwegian health authorities on the policy measures to be implemented is still not known.

5 | DISCUSSION

The aforementioned expert report from 2016 pointed to a recurrence of risk for iodine deficiency and goitre in Norway. The goitre problem seems to have disappeared in the 1950s with the consumption of iodine-rich milk, but mild-to-moderate iodine deficiency has since reappeared with the decline of milk and fish consumption from the early 2000s. When goitre was a widespread problem 90–100 years ago, Norway did not follow recommendations from the Bern conferences about adding iodine to table salt all over the country. In this present article, we have aimed to address this puzzle, exploring Norwegian goitre-iodine research over time and the relationships between science and policy in the handling of the goitre problem.

[103]Rimington & Miley (1960, p. 655).
[104]Frey, Rosenlund, & Storli (1974).
[105]Frey et al. (1981).
[106]Renaa & Staveland (1974).
[107]Løvik & Tangen (1978).
[108]Laurberg et al. (2000).
[109]Dahl, Meltzer, Opsahl, & Julshamn (2003).
[110]Haugen, Brantsaeter, Alexander, & Meltzer (2008).
[111]Norwegian Nutrition Council (2016).
[112]Information on the website of the Norwegian Scientific Committee for Food and Environment (https://www.vkm.no/) Henjum, et al, 2020.

The first medical publications on goitre in Norway appeared in the mid-1800s. Through medical journals, Norwegian physicians were introduced to goitre research that was performed abroad and to the possible relationships between goitre and iodine status. The interest in researching such problems can be connected to experiences from practising in the Norwegian goitre districts. During the first period (up to the 1920s), the university offered contributions regarding the possible causes and prevalence of goitre, but no state-level policy action was taken. In the second period (1920s to 1950), researchers from the fields of surgery and chemistry contributed to and were recognised by the international goitre-iodine research community. In the 1920s and 1930s, surgeon Holst and chemist Lunde were especially active in the international goitre-iodine scientific community. They combined basic research with discussions on policies for goitre prevention. During the 1920s and 1930s, however, Norwegian nutrition research and policy communities were concerned with other issues, as were their counterparts in other European countries. During the quiet years, milk consumption was high, resulting in an adequate iodine intake.

In Norway, the goitre-iodine question thus seems to have been at the fringes of nutrition-related interest. Food and nutrition issues attributed to the economic crisis, inflation, unemployment, and the increased need for economic support to unemployed and poor people to avoid malnutrition were on the political agenda. In the 1930s, conflicts over food standards and support for poor people followed an international pattern, in which physiologists were less oriented towards social policy than researchers from hygiene and public health.[113] In the same period, the goitre-iodine issue was important in Switzerland and other countries with a goitre problem, while it was on the fringes of Norway's nutrition policy.

In Norwegian goitre-iodine history, adding iodine to salt, seeking to increase the intake of seawater fish, and fortifying cattle fodder with iodine were the three strategies proposed and discussed in the 1920s and 1930s, but which were not implemented by national health authorities. Some newspapers contributed by reporting on research and on local initiatives to combat goitre problems, but newspaper engagement was not enough. Local public health actors changed the situation, but no central health authority took interest in the issue.

Sweden implemented general iodine fortification of salt earlier than Norway and at a much higher concentration. One important reason was probably that the goitre regions were larger in Sweden than in Norway.[114] We also would like to consider some other possible explanations. From a public health perspective, Swedish physician Axel Højer participated in the 1933 Bern conference and became Sweden's Director of Health in 1935. It is reasonable to assume that his position allowed to contribute significantly to policies pertaining to the fortification of table salt with iodine in Sweden. The Swedish example may illustrate that it is easier to implement new actions when there are close connections between science and public health. The Norwegian Bern participants, Holst and Lunde, were not connected to health authorities locally or nationally. On the other hand, during World War II, Lunde held a position as a Nazi minister and might have had opportunity to influence goitre-iodine policy. He died after 2 years in the position. Since we cannot find any reference to iodine issues in his political speeches, we find it reasonable to conclude that he was not involved with the health authorities on this issue. Holst was a professor of surgery and a clinician. He was respected but apparently had no connection to the health authorities.[115] Lunde was a chemist and not a physician like Holst and Höjer, which may have given his research and advice to the medical authorities less authority.

Also, and most importantly, Lunde became involved with the Norwegian Nazi Party in 1933, acting locally in Stavanger. From the perspective of the Norwegian social-democratic government (from 1935), Lunde was not a researcher to listen to. Before the German occupation of Norway in April 1940, he had little political credibility. After the occupation, Lunde received the position as Norway's Nazi minister of cultural affairs, a position he held until his death in a car accident in October 1942.[116] It is likely that his political engagement with the Nazi party also diminished the impact of his research after the war. His co-writers on iodine and goitre from the 1920s and early 1930s abandoned this research topic after the war—Holst did so earlier, after 1933. We find it reasonable to assume that

[113]Elvbakken (2020).
[114]Kelly & Snedden (1958).
[115]Larsen (1996).
[116]Arntsen & Harestad (2012).

this specific political context relating to goitre-iodine research in Norway contributed to the silence about this issue after World War II.

As we have seen, Norwegian Director of Health Evang (from 1938–1972) was engaged in food and nutrition policy from the 1930s and was given the most senior position in the nutrition council from 1946–1952. He cooperated with Axel Højer, his Swedish colleague, on many other issues, but Evang did not engage in the goitre and iodine issue.[117] Why was this? Why did Evang not look into goitre-iodine research and its researchers, like his colleague in Sweden did?

One can speculate whether this was due to Lunde being a outspoken opponent of Evang, a stance that was highly visible in several of Lunde's speeches.[118] Lunde characterised Evang as the most dangerous Norwegian physician for promoting contraception and the depopulation of the country, as Evang also was an active sex reformer.[119] Evang did not confront Lunde; rather, he ignored him. On the other hand, from a public health perspective, Evang was also actively promoting a socialist nutrition policy.[120] But he had not, like the physicians that wrote on goitre in certain districts in the 1930s, been a district physician in an area where goitre was present. Evang followed the Norwegian king and his government in exile to London in 1940 and worked together with them during the war, especially with the minister of social affairs, to whom the Director of Health reported. He pursued issues such as food supply and nutrition, and worked towards the establishment of organisations like the WHO and FAO.[121]

When Evang was appointed Director of Health in 1938, his main competitor was Sverre Kjølstad, the county physician who was formerly engaged in the goitre-iodine issue, as we have shown. It is reasonable to assume that Kjølstad might have worked more actively to improve iodine regulations as the Director of Health than did Evang, and that Kjølstad would have followed the Swedish practise if he had become Director. A hygiene or public health interest in the goitre-iodine issue might have resulted in the implementation of other policies at the central government level.

Following this, the differences between the Norwegian goitre and iodine policy and that of Sweden might be linked to the differences in relationships between researchers and policymakers and the political orientations and values of leading state officials.

6 | CONCLUSION

Certain conditions must be met if new knowledge is to actually lead to new policies. The authority and legitimacy that science and researchers might earn do not solely rest on the quality of the research. Political issues that extend beyond a specific case might also influence the legitimacy of the research. We argue that the professional orientation and perspectives of leading health authority actors might have an impact on which preventive measures and topics were given priority. Key health authority personnel had other priorities, which were likely to have had an influence. Norwegian Director of Health Evang showed no interest in the goitre-iodine issue. Moreover, one of the main iodine and goitre researchers was politically discredited—and one of the few Norwegian physicians that took an interest in the issue was Evang's competitor. Thus, to understand the relationships between science and policymaking, we have to understand both the scientific development and the political contexts and conflicts within specific periods.

When the Norwegian expert committee in 2016 recommended several measures to be implemented to prevent goitre, increasing the concentration of iodine in table salt was among their policy recommendations. The committee

[117]Nordby (1989); Evang (1940; 1947).
[118]Lunde (1943).
[119]Andresen & Elvbakken (2017).
[120]Evang & Galtung Hansen (1937).
[121]Nordby (1989).

further argued for systematic monitoring of Norway's goitre-iodine situation.[122] The 2016 report recommendations are in some ways a recap of the discussions that have been taking place since 1920.

In our opinion, this history demonstrates some general aspects of the relationships between science and policy. The recommendation from the goitre-iodine research communities to implement iodine enrichment of table salt to prevent goitre, given at three conferences before 1940, was not contested—the recommendation was widely agreed upon. It was not an unclear or contested knowledge that was neglected by the Norwegian health authorities in the 1930s and 1940s. Goitre affected only certain areas in Norway, mostly inland valleys and lake areas. Thus, goitre is likely to have been considered a local problem and was low on the public health authorities' list of priorities, compared to the unemployment, malnutrition, and poverty issues that affected the whole country and the European situation in those days.

The recommended measures can be said to have involved conflicts of interest. Several of the researchers aimed at solving the goitre issue through increased intake of iodine-rich white saltwater fish. Fishing was and remains an integral part of the Norwegian economy, and fishing interests have always been strong. On the other hand, adding iodine to table salt would not benefit other interest groups such as the pharmaceutical industry, which did have an interest in vitamin and mineral products.[123]

Finally, another aspect may help with understanding why Norwegian authorities did not follow the recommendations from researchers. Although the Norwegian researchers who had brought the international consensus on policy measures home to Norway came from the university and research laboratories in Stavanger, both of which are respected institutions, the researchers did not come from the field of public health or disciplines related to nutrition, as surgery was a clinical medical discipline. It must also have been important that one of the main goitre-iodine researchers, Lunde, was a profiled Nazi party member in the 1930s, and a Nazi minister during the Nazi occupation. For the Norwegian public health and nutrition research community (and from the late 1930s, the social-democratic government and health administration), this fact is likely to have overshadowed the quality of Lunde's scientific works. We find it useful to scrutinise the credibility of the researchers—not necessarily as researchers, but as political actors—in studies of relationships between science and policy. Also, what happens at the local level should be explored when studying science and policy relationships. One main argument is that the researcher's credibility matters, and this is something that should not be overlooked.

CONFLICT OF INTEREST

No conflict of interest to report.

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