OBSERVATIONS ON THE IMPLEMENTATION OF SALT FLUORIDATION FOR THE PREVENTION OF DENTAL CARIES

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INTRODUCTION

Salt for human consumption has been an important and successful tool in public health for several decades as a carrier for iodine for prevention of Iodine Deficiency Diseases (IDD –goiter and crippling diseases causing irreparable intellectual impairment and stunted growth), and fluoride for prevention of dental caries. Fluoride was first added to salt in the mid 1950s (1) in Switzerland, and its use has expanded to other countries in Europe, the Americas, and now to other regions of the world (2).

In 1977 at the First International Symposium on Salt Fluoridation held in Medellin, Colombia, developed by PAHO, supported in part by the W.K.Kellogg Foundation, and attended by experts in public health, nutrition, and the salt industry, it was concluded that "..based on the present state of knowledge, fluoridation of salt is a safe and effective measure for partial control of dental caries and its wider use should be encouraged and supported" (3).

In May 2000, at the 8th World Salt Symposium ("Salt 2000"), executives of the salt industry met with leaders of governments, NGOs and international organizations to discuss how to better collaborate on eliminating IDD forever. A global coalition of public, private, international, and civic organizations was formed whose goal would be the sustained elimination of iodine deficiency disorders through universal salt iodization. Two years later at a UN General Assembly event (A Smart Start for Children), the "Network for Sustained Elimination of Iodine Deficiency" or the Iodine Network was launched.

At the same meeting, the first presentations on the use of salt fluoridation to prevent dental disease were made (4, 5, 6, 7, 8).These referred to the technology, monitoring, epidemiological surveillance, and the experiences of programs of salt fluoridation in countries of the Americas. This paper aims to illustrate subsequent major initiatives, international variety of application, resulting impact in countries and communities involved, and approaches for the future.

BACKGROUND

Oral Health is an integral component of general health and general health is associated with economic development, particularly in developing countries. Dental caries is a highly prevalent chronic multifactorial infectious disease with consequences resulting in pain, suffering, and diminished quality of life.Oral Health tends not to receive high priority within morbidity and mortality focused government programs. However, it does present a constant and significant

problem to the population and national programs in terms of impact and cost. Untreated dental disease impacts negatively upon the general health, academic performance, school attendance, absence from work, and employment possibilities of the future generation.

Treatment of dental caries is expensive, palliative, and requires human resource intervention. Costs account for between 4 to 11% of health budgets of European countries. On a population basis, particularly dental caries, is stated to be the most expensive human disease in terms of direct costs, and is the most expensive part of the body to treat. The direct cost of caries treatment in Germany was 20.2 billion DM, cardiovascular disease 15.4 billion DM, diabetes 2.3 billion DM (9). In West Germany, the cost of dental care was 10.3% of the health budget in 1994 (10, 11).

The average dental caries activity among most of the very young, lower socio-economic, and in immigrant groups without access to information and community prevention, tends to be higher. While caries levels are decreasing in many developed countries, they are increasing, particularly among pre-school children, in those without access to community prevention, and in the immigrant population in Europe (12). A study of dental treatment needs in Scotland (13) concluded that the treatment costs between a fluoridated water and non fluoridated community were 45% lower in 4-5 year olds and 47% lower in 9-10 year olds.

A secular decline in dental caries prevalence was obtained in almost all highly industrialized countries, attributed mainly to extensive and frequent tooth brushing with fluoridated toothpastes. Globally, this is an expensive approach, and, despite the WHO-Technical Report 846 of 1994, and many subsequent similar statements that "every effort must be made to develop affordable fluoridated toothpastes in developing countries", progress has been limited. It is suggested that fluoridated toothpaste currently reaches some 30% of the world's population.

In the 20 years since the iron curtain fell, it was envisaged that a decrease of caries prevalence, as documented in Western Europe, would occur in Eastern Europe. This only occurred in the former Eastern Germany with access to support and products from West Germany. In the remaining countries, there is no consistent decline; children at 12 years of age still have more than twice as many decayed teeth when compared to the same age group in the West (14).

A confirmed urgent need exists for the implementation of economic, sustainable, community wide, readily accessible, or preferably universal/automatic, programs to prevent the most prevalent oral diseases. Such can be implemented through fluoridated salt at 1% of the cost of a toothpaste based program.

Communities where water supplies naturally contain levels of fluoride in the region of 1 ppm or higher, have historically illustrated decreased prevalence of dental caries, the most prevalent chronic disease in children. Studies in the USA have identified the beneficial levels of this element and that adjustment of water fluoride content could reduce the prevalence of dental caries by an estimated 50% (15).

Based on these studies, water fluoridation became the major community preventive measure for caries in North America, Australia, and other developed countries. For 86% of the US population on public water supplies the fluoride content has been adjusted, permitting an estimated 70% of the total population the benefits from this approach (16). Other applications of fluoride to prevent caries involve toothpaste, solutions, gels, chewing gum, and varnish, all of which have been in use illustrating decrease in disease levels, either individually or jointly.Fluoride, particularly in toothpastes, is a very important preventive agent against dental caries. Tooth brushing without fluorides affords little prevention against caries.

Globally, and in many cases nationally, water fluoridation cannot be implemented universally due to absence of, or lack of access to, treated water supplies, economic circumstances, fluoride compounds, and for socio-cultural reasons. Alternative approaches and vehicles were needed to achieve effective community coverage. These involved the use of milk or salt, both of which have illustrated safety and effective impact upon dental disease (2). They were recently recommended by the WHO World Health Assembly, Geneva 2007, when water fluoridation could not be implemented for whatever reason (17).

CURRENT SITUATION

Fluoride is the main factor altering the resistance of teeth to acid attack and interacting with sugars in plaque. Fluoride affects tooth structure during tooth development and post-eruptively, and reduces caries. Effective use of fluoride is an essential approach to prevent dental caries and forms a vital part of the WHO Global Oral Health Strategy (18).

Population-wide automatic fluoridation measures are considered the most effective when supplemented by improved use of toothpastes containing fluoride. Fluoride in toothpaste, through the topical effect, is considered to be the most important reason for the decline in caries in Europe (19). Regrettably, many populations with limited resources do not have access to this measure. Despite continued illustrated capacity to reduce community caries prevalence levels, when provided as recommended in fluoride deficient populations, the rate of implementation of water fluoridation, even in developed countries, has been slow. For example, in the USA, 30% of the population and 57% in Canada (20) do not have access to community wide fluorides. In the USA, despite health policy, the population covered by this approach has only increased 7.1% in the period 1992-2006 (15). There is no effective population wide alternative provided for Alaska, Puerto Rico, and the Virgin Islands. Puerto Rico, for example, was one of the first to fluoridate water supplies in the 1960s.Due to the water distribution system and economic factors , it has not been able to fluoridate water for years, and apparently has not been able to implement an alternative community wide approach on account of existing US regulations. Another example exists in England, where despite additional health legislation in 1985, only 10% of the population has water fluoridation and little progress has been made in the past decade.

In the Latin America, Brazil, has implemented water fluoridation in major cities and plans are to fluoridate 500 new water supplies in 2009 (21).The needs for more extensive community disease prevention exist in many areas, but there has been no significant increased water fluoridation reported in other countries over the past decade, with the exception of Santiago, Chile.

In a community wide and public health approach, mass fluoridation is more economical and effective. In this context, salt fluoridation, which has been shown to be safe and cost-effective, can be made available to all as an alternative at a fraction of the cost of water fluoridation.

Fluoridated salt has been used for the prevention of dental caries for 54 years where fluoride supplementation was needed for disease prevention and other community approaches were not feasible or comprehensive. In the past 25 years there have been major international initiatives in use of salt as a vehicle. Zurich celebrated 50 years of salt fluoridation in 2005, and this approach now involves all Switzerland (2). Salt fluoridation is similar to iodization, and is fully compatible with the latter, permitting many programs to provide a combined iodized and fluoridated salt product.

In Latin America advances made by salt fluoridation over the last 10 years have been gradual but significant. The process has matured and greater collaboration between manufacturers and regulators has improved the consistency and quality of the fluoridated salt. Medium and large manufacturers have been modernizing and improving the quality of their products in response to consumer demand and worldwide trends in this direction. Mexico, Uruguay, Venezuela, Costa Rica, Peru, Cuba, and Jamaica, and to some extent Ecuador, have continued a trend of quality improvement with less variation of fluoride content in salt and more results from monitoring adhering to the specifications of 250ppm Fluoride ion. On the other hand small undercapitalized salt producers have not been able to make the necessary investments in plant and personnel to upgrade their operations and product quality. This has resulted in intermittent addition of fortificants to salt such as fluoride and iodide.

The countries of Jamaica and Costa Rica, both of whom previously attempted water fluoridation, opted for nationwide salt fluoridation, and recently celebrated over 20 years of the effectiveness of this choice with 84% and 70% reductions in caries prevalence in 12 year olds (22 ,23). Mexico has now implemented a nation wide program of salt fluoridation, carefully structured to avoid areas with excess fluoride levels in the water supplies, and reported 40% reductions in caries prevalence (24, 25).

Different approaches have involved complete coverage in all domestic salt

("universal"), or choice, regionalized distribution in countries with high and low fluoride areas, provision in school canteens, inclusion in bakery bread, and availability for choice selection in shops. The degree of implementation has depended upon the approach used, with freedom of choice requiring continued active promotion and provision of information by health authorities to achieve and maintain market shares impacting on public health. Several countries have attained high market shares: Switzerland (83%), Jamaica (98%), Mexico (80%), Germany (68%), Costa Rica (90%), Colombia (90%), and Uruguay (90%). France, in Europe, and Cuba, Ecuador, Peru, Trinidad & Tobago, and Venezuela, in the Americas reported national coverage (2). It is understood some 12 additional countries, some of them now in Asia, are in various stages of implementing this approach, but have not indicated significant sales or market shares of fluoridated salt.

There has been a notable increase in interest to utilize salt as a vehicle for fluorides from small and developing economy countries, particularly in Eastern Europe, the CIS, and Asia, as oral disease levels rise together with the costs of health interventions. Many have rudimentary salt installations, may not produce their own refined domestic salt, and economically may not be able to afford the initial and recurring costs. Countries, for example, Belize, and Scotland that do not have water fluoridation and do not produce fluoridated salt, do take advantage of this preventive approach and have it available for individual purchase.

Major salt producers have a role to play through their dominance, influence, expertise, and exports in geographic areas – China in Asia, and India in the subcontinent and the Middle East, for example.

SIGNIFICANT ACTIONS IN THE PAST DECADE

Many significant actions and events have followed the 8th World Salt Symposium which favor the implementation of alternative population wide approaches recommended by WHO.

Today the Iodine Network continues to fulfill the goals that inspired it; through the harmonization of efforts between corporate, health, and governmental bodies, salt producers, and distributors, and the Micronutrient Initiative. It is therefore an example of how salt can be used internationally for disease prevention acceptable to the public.

Dr. Christian Voumard UNICEF Representative in a Speech on IDD Teleconference, November 2006, on the "Initiative for sustainable elimination of IDD in China" stated that by 1999 (three years after program initiation in 1996) China achieved 90 percent household access to iodised salt, and by 2002 the national IDD Survey reported all but seven provinces had adequate levels of salt iodization. He concluded that the Chinese Government had controlled iodine deficiency to the point of near elimination.

The ability to include fluoride in domestic salt exists within the provisions of the health statutes and regulations in many countries and permit ready initiation without many of the problems and barriers associated with water fluoridation (26). Internationally, the addition of fluoride to domestic salt has been included in the revised Codex Alimentarius 150 (27), and it is expected that further information will be included in future revisions. In the EU the use of sodium and potassium fluorides was maintained and approved in the EU Parliament decision on food additives (2006) (28).

This flexibility, together with the experience of salt iodization, has permitted the introduction of fluoridated salt prior to national legislation specifically directed to this approach. Subsequent national legislation has identified conditions and ranges for fluoride addition in domestic salt, obligatory inclusion (Jamaica), zoned distribution (Mexico) and even required market share (Uruguay) for the particular national market.

The World Health Organization and the World Dental Federation held a Global Consultation in 2006 dedicated to implementation of fluoride programs, in which salt fluoridation was included. The subsequent WHO resolution (WHA 60; 17, 2007) at the World health Assembly, 2007, recommended salt fluoridation as an alternative where water fluoridation could not be implemented.

The Pan American Health Organization /WHO published the experience of salt fluoridation in the Americas with guidelines for legislation and implementation (29); the CDC declared fluoridation the 10th most significant advance in public health (30), and

the Center for Global Development declared the salt fluoridation approach one of the 20 most significant advances in public health in the 20th century (31).

The "Declaration on Child Oral Health" (2005) recognised that "In industrialised countries the majority of school children are affected by dental decay, disease levels being highest in the under-privileged groups, that disease levels are increasing rapidly in the developing countries, and effective prevention is a realistic goal" (32).

Clinical & epidemiological evidence based on over 50 years of experience in other trials and sites has illustrated:

The incorporation of fluoride in refined domestic salt, within the range recommended by WHO, results in decreased prevalence of dental caries in both the primary and permanent dentitions. The recent study and confirmation of added impact of ingested fluoride (33) substantiates observations of the benefit of pre-eruptive and post eruptive effect of fluorides in caries prevention.

Studies from China have shown the beneficial impact of fluoridated salt in both dentitions and the absence of fluorosis using this approach.

In China 74% of cities have a fluoride concentration lower than 0.3ppm; only 6% were over 0.5ppm, and 17% of 12-year-olds and 10% of 18-year-olds use fluoride toothpaste, according to the 2nd National Oral Health Survey (34). A 3-year single blind randomized controlled trial (RCT) of the effect of salt fluoridation on dental caries in primary teeth of 414 3-4 year-old kindergarten children in Wuhan city, with an average salt consumption of 3-4g per day using 200-250ppm fluoridated salt resulted in 50% reduction in caries experience at the end of the trial. Subsequent caries prevalence of children in the test group after 1-2 years showed 66% and 48% reductions respectively, and was significantly lower than those of the control group in all 4 years. No enamel fluorosis was found (35).

It was concluded that 200-250ppm fluoridated salt was an effective and safe way to prevent dental caries in primary teeth and remained effective on permanent first molars after the program had stopped for 1- 4 years (36).

The availability of fluoride and iodide jointly in salt has proven compatibility (37, 38), and has had positive impact upon the elimination of IDD and decrease in dental caries. It has proven to be effective in different cultural and climatic environments, and socio – economic groups. The technology of fluoride addition to salt is similar to iodization and therefore readily understood and available for salt processors.

Potassium and sodium fluoride compounds are preferred in salt fluoridation. No further community applications using calcium fluoride (shown to be effective in the Colombia trial) have been reported and the effectiveness of the trial has been vindicated in the Americas, despite variation from the original additive formula which proved to be unsustainable economically for the region.

The capability of developing economy countries to produce and now export fluoridated salt.

Fluoridated salt, where available, has been widely and well accepted by the consumer.

Negative claims regarding harmful effects of fluoride (namely unsightly enamel fluorosis) when added to salt (at the usual concentrations from 180 to 250 ppm F), were not substantiated. Fluoridated salt has shown no correlation with an increase in unaesthetic enamel fluorosis.

Capability to provide a lifelong beneficial effect through continuous or frequent fluoride availability in the oral cavity.

Results in caries prevention are comparable to water fluoridation (39).

Low economic cost – even compared with water fluoridation – and sustainable in developing economy countries

Fluoride prevention through salt can be implemented, nationally or locally, with or without freedom of choice, in countries with existing high or low water fluoride levels, and in limited or specified areas and populations.

DISCUSSION

It is generally accepted that fluorides are essential for the prevention of dental caries. Water fluoridation was the original community approach for use in areas deficient in fluoride levels for caries prevention following studies in the USA. However, different approaches have been utilized in different countries where the mode of administration generates debate and identifies the feasibility of any particular approach.

It is also recognized that there are areas

of countries and the world (areas of China, India, Pakistan, East Africa, Rift Valley) where excess fluoride ingestion, sometimes combined with nutritional deficiencies, result in skeletal and dental enamel fluorosis. Fluoride levels encountered in these areas are far in excess of those proposed and implemented in caries prevention. This distinction, nor that between dental enamel fluorosis and skeletal fluorosis, is never made sufficiently clear to the public.

Recent studies have reported enamel fluorosis prevalence ranging from 3% to 42%. Lack of standardization and use of different grading scales is considered the main reason for this wide range. The most frequently used instrument (Dean's index) equates anything other than 0 (Absence of fluorosis) as fluorosis, irrespective of the grade.

Enamel fluorosis is not associated with health damage, and the dentine of the teeth is not affected. With mild enamel fluorosis, the teeth tend to appear whitened, and in surveys carried out with projected photographs, "fluorosis grade 1" has approval for a pleasing bright white look (40).

Since unsightly enamel fluorosis represents only a very small percentage, usually less than 1.5%, in most fluoride programs, this grossly distorts the negative aspect of fluoride impact. A community fluorosis index (CFI), carried out by trained and calibrated examiners, which permits identification of objectionable fluorosis in community groups, is seldom reported, and would assist determining whether such fluorosis is a public health concern. WHO recommends that examiners undergo training by an expert and examine individuals with absence and presence of fluorotic enamel (41).

Fluorosis with discolouration of the front teeth is increasing even in part of the communities with no artificial water fluoridation. Ingestion of attractively flavoured fluoride toothpaste (usually with 1000 to 1500 ppm F) by children up to the age of four years appears to be another reason for the varying results. In most European countries low fluoride toothpastes (usually with 250 to 500 ppm F) are now available for this age group, and enamel fluorosis has not been a problem during the last decades in Europe.

The proposed introduction of water fluoridation in countries where public consultation is involved or predominant in the decision making, is frequently accompanied by a barrage of negative information relating to "mass medication", the impacts of skeletal fluorosis experience, and becomes a political issue. The antagonism created by use of the phrase "mass medication" frequently is sufficient to negate evidence based, accurate, scientific information, and prevent introduction of water fluoridation. In the Netherlands for instance, more than 95% of the water could have been easily fluoridated, but the legislation was unsuccessful. Similar situations occurred in other countries or regions, where large cities could have been fluoridated, but this was rejected.

There is obviously a need for more effective provision of accurate and scientifically validated information regarding fluoridation. New communication systems permit ready access of individuals – and not only academicians -to the internet. This enables incorrect statements to be included such that the internet is not proof of scientific validity, and the freedom to express an opinion has been used to promote certain positions and interests. Fluoridation is a case in point, where a look for this term will identify a number of sites with well meaning titles, but which espouse positions that are in effect contrary to use of fluorides. It takes only a few seconds to enter in the internet "Fluoride is a poison" and reach a global audience. Similarly, misinformation about salt iodization is distributed via the internet. However, iodization with an 80 year tradition, and IDD prevention exclusively dependent on iodine supply, currently does not face the same degree of the problem, such that from 20% in 1990, now 70% of the world consumes iodized salt.

This, plus certain technical aspects, such as the extent of treated water systems, water quality, local technical expertise, and economics, has impeded the implementation of water fluoridation in many countries.

Politically, it is relatively easy to offer free choice to the consumer to purchase salt with or without fluoride: this does not result in anti-fluoride activities, since it provides freedom of choice, is an accepted vehicle, and a better quality product. From a public health perspective, high market share, or better universal use of fluoridated salt, will always be preferable. Lower socio-economic strata tend to make consistently less use of possibilities of prevention, and the majority reached only under conditions of universal or

near-universal usage. However, where free choice is involved, the use of fluoridated salt must be promoted continually to have a community effect. This has been implemented in Germany where 70% of 12 year olds were caries free in 2005 (14), but not in France, Austria and the Czech and Slovac Republics, for example, where insufficient promotion has resulted in low percentages of fluoridated salt users.

International agencies predict that 90% of population growth will occur in developing countries, and that dental caries will increase in those populations unless prevented. The world population is approximately 6.7 billion of which an estimated 27% is aged 0-14 years (estimated 1.8 billion) and is projected to increase by 160 million by 2015 (42). With an estimated population currently of less than 10% with water fluoridation, and 30% with access to fluoridated toothpastes, mainly in developed economy countries, it is evident that effective and economic strategies need to be implemented immediately to prevent and reduce disease in the future generation.

The first trial of salt fluoridation in the Americas (Antioquia, Colombia) was financed and received technical assistance from eminent researchers through the USA National Institutes of Health, some 47 years ago (3). Despite the final conclusions, and despite knowledge of the successful development and subsequent results of many country programs, it appears that so far no attempt to provide fluoridated salt has been made by the US for their populations without access to water fluoridation, of which Alaska and Puerto Rico are a current example.

A frequent concern expressed when discussing salt fluoridation relates to salt intake, daily salt consumption, and potential implications for heart disease. Here the distinction between overall daily personal salt intake and the components or additives included in iodized and fluoridated salt must be made. The important factor is the intake of sodium, which is minimally increased by use of sodium fluoride salt and in very low proportion (250/1,000,000=0.00025), precluding any cardiac effect. Many programs use potassium compounds for both iodide and fluoride, depending on the technical method of adding fluoride and iodine in the manufacturing process.

The costs for salt fluoridation are in the nature of under US$0.10 per capita per year depending on the process and existing infrastructures (2); quality control and surveillance are included in the US$0.10. This is approximately 10% of the cost of water fluoridation for comparable results and 1% of a toothpaste program. Even in India, based on a daily income for the poor of US$0.75 per day, the cost for a year of dental caries prevention through fluoridated salt would represent only an estimated 13 % of one day's wages. This is infinitely cheaper than even one visit to a dentist, if one is accessible.

The success of the UNICEF iodization program has greatly expanded the ability and expertise to implement salt iodization in developing countries, such that much of the equipment and staff already are available, thereby facilitating the addition of fluoride and reducing start up costs and investment. Accurate, simple and relatively inexpensive equipment is available for determining fluoride. The use of specific ion electrodes can be used for determining fluoride in multiple applications including fluoride in water, salt, milk and renal excretions. This provides a valuable tool at the processing plant and for epidemiological surveillance and monitoring in community groups.

The decision and condition, established with the initiation of the salt fluoridation program in the Canton of Zurich in 1955, to market fluoridated and iodized salt at the same price as salt without these additives has been proven a positive factor in the extension and acceptance of fluoridated salt, and has been followed subsequently and successfully in many countries (43).

CONCLUSIONS

The use of fluorides is essential for the community prevention of dental caries. They are used in all countries in a different variety of approaches and applications. Only one ingested community fluoride additive should be permitted, either in water, salt, or milk. "Mild" overlap of use of fluoridated salt with consumption of fluoridated milk or water, as has occurred in thousands of Swiss families, has not resulted in enamel fluorosis problems. More important is the use of low fluoride dentifrices for children up to four to six years due to toothpaste swallowing. Subsequently, ingested fluoride programs should be combined with fluoridated toothpaste (at 1100-1500 ppm), oral hygiene instruction, fluoride varnish, and diet counseling.

The evidence over more than 50 years has illustrated the ability of the addition of fluoride to domestic salt to reduce dental caries, not produce harmful effects, and be a viable, economic, and effective alternative to water fluoridation for population wide coverage. The inclusion of fluoride in domestic salt has not been shown to increase daily salt consumption, in accordance with the observations on salt iodization.

Salt fluoridation is sustainable by developing countries and has been considered one of the major contributions to public health in the 20th century. Added initiatives and use would enable millions more children and older populations to benefit from dental caries prevention, improved oral health, reduced dental interventions, at minimum costs.There is a need for information to be disseminated on the feasibility of salt fluoridation, and greater collaboration developed between salt producers, marketers, cooperatives, health officials, providers, nutritionists, government, and the private sector, to increase the availability of prevention to the ever growing world population in need. The expertise and experience exist and are available.

The ability to permit the use of fluoridated salt exists within the health regulations of many countries, and has been initiated and implemented through a variety of approaches. Greater harmonization with the content of legislation and regulations relative to salt iodization needs to be made. The availability of such information should be extended; the Codex and EU legislation and information appropriately modified and updated; and fluoridated salt recorded in the "generally recognized as safe" (GRAS) category in US FDA regulations.

The initiative and collaboration of the salt industry in the Americas, and a few European countries, has been a major factor in the successful implementation of a disease preventive measure for dental caries and the improvement of oral health of the population in the regions. However, the need exists to improve and expand national capability for monitoring and evaluation.

The creation and subsequent implementation of the Iodine Network was facilitated through collaboration of producers, marketers, health officials, dental, medical and pediatric associations, and government agencies, working in conjunction with WHO and international agencies. It has illustrated the feasibility and international effectiveness of salt as a vehicle for disease prevention.

The conditions are right for use of a similar approach and the creation of a similar Fluoride Network by the salt industry involving UNICEF, WHO, and international financing agencies, or the incorporation of fluoride into the salt related programs and micronutrient initiatives of these agencies. Such action would present an approach to benefit millions of children and prevent the pain, discomfort, and impact of dental disease rapidly and immediately.

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