FLUORIDE INTERVENTION TEMPLATE (FIT)

FOR THE SELECTION OF

NATIONAL FLUORIDATION STRATEGIES

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FLUORIDE INTERVENTION TEMPLATE (FIT) FOR THE SELECTION OF NATIONAL FLUORIDATION STRATEGIES

INTRODUCTION TO FIT

The Fluoride Intervention Template (FIT) is a decision making matrix or tool for the systematic selection of fluoride interventions for improving oral health. It is a decision making tool for individuals or groups of stakeholders to assist in the selection or prioritisation of various fluoride interventions at the community, regional or national level. This technique provides a visible, structured, orderly set of criteria or factors which need to be considered when choosing a fluoride strategy. As much information as possible concerning the various fluoride options need to be collected and reviewed by the individual/stakeholders prior to the application of FIT. If FIT is utilised by a group of stakeholders, the selection of a facilitator or chair person will aid in smooth completion of the FIT process.

After the selection of the fluoride intervention, a situational analysis and a strategic plan will aid in the eventual implementation of the fluoride intervention.

A situational analysis identifies the current state of fluoridation in the community, region or nation and aids in the identification of the barriers and gaps, and additional information required for the full implementation of selected fluoridation strategies.

The strategic plan defines the aims, objectives, activities, responsibilities and budget required to implement the fluoride intervention by a defined date.

STAGES OF FIT

The steps in the FIT process include:
1. Selection of criteria
2. Developing scoring criteria
3. Weighting the criteria
4. Review of the interventions
5. Completing the matrix
6. Arriving at group consensus

1. **Selection of criteria:** From the list of recommended criteria (refer to the next section) the individual or group of stakeholders select a set of criteria which would aid in the selection and prioritisation of interventions. The group should brainstorm and reach consensus on a manageable number criteria from the list of recommendations. The group may also wish to develop and choose criteria not already on the list.

2. **Developing scoring criteria:** The following recommended scoring system for each criteria be applied:

Score	Scale
1	Criteria does not apply or is of low relevance
2	very poor
3	poor
4	average
5	good
6	very good

By using scores, the question, "What is the quality of the fluoride intervention in relation to the criteria?" is answered. The individual/group may also wish to develop their own scoring method.

3. **Weighting the criteria:** If some criteria are considered more important than others by members of the group, assign weights to reflect this importance.

Score	Importance
1	low
2	medium
3	high

The numeric score for each criteria is then multiplied by the weight.

4. **Review of the interventions:** Information collected on the various fluoride interventions is reviewed prior to the completion of the matrix.

5. **Complete the matrix:** Complete the fluoride intervention selection process using matrix form (refer to end of this section for an example of the matrix form) and following the steps below:
   a. Enter the criteria selected across the top of the form.
   b. Enter the interventions in the cells in the column "Interventions".
   c. Enter the weights assigned to each criteria in the parenthesis ( ) below the criteria.
   d. For each criteria enter the score (1 to 3).
   e. Next multiply the score (1 to 3) by the assigned weight (1 to 3) and write the result in the scoring box. E.g. Criteria #1 score may be medium relevance and assigned a weight of 2; therefore, the score is 2 X 2 = 4.
   f. Under the column "Total", the weighted scores for the criteria for each intervention will be summed.
   g. Complete the same steps for all the selected interventions.

The matrix form is submitted to the facilitator who will sum up the total scores for each intervention and transfer the figures to a 'master' Fluoride Intervention Template (FIT). The results are reviewed and discussed by the group with reference to the appropriateness of the selected priority intervention for improving oral health or reducing the burden of dental caries.

LIST OF CRITERIA AND DESCRIPTION

Listed below are the criteria which need to be considered in selecting or prioritising a fluoride intervention and the description or factors which either aids in defining the criteria or needs to be considered in scoring and/or weighting the criteria.

- ***Equitable***: The potential for the fluoride vehicle is accessible to the entire population regardless of geography, social class, gender or age.
- ***Effective***: There is good evidence to show that the intervention is effective in preventing caries in all age groups and in the primary and permanent dentition.
- ***Efficient and sustainable***: The intervention is low cost and affordable to the community or nation and reduces the cost for restorative treatment. The population is able to financially sustain the continuance of the intervention.
- ***Safe***: The intervention causes no physical, social, psychological or emotional harm.
- ***Complianc***e: The intervention does not require the cooperation or change in behaviour of individuals of the target group in order for it to be effective.
- ***Feasible***: The country has the human capacity, technology and infrastructure to implement the fluoride intervention.
- ***Legislation***: Laws and regulations are necessary for the introduction and sustainability of the fluoridation programme, fluoride dosage and/or quality control mechanisms.
- ***Quality control:*** To ensure quality and safety, standards and measures are required to monitor the quantity and quality of chemicals added to the product. Personnel need to be trained to carry out simple, effective and efficient tests.
- ***Monitoring and surveillance***: Epidemiological surveillance of the fluoridation programme is necessary to determine the proper dosage of fluoride to achieve maximum protection and minimum undesirable side effects.
- ***Application in high fluoride areas***: The introduction of the fluoride programme may be problematic in geographic areas where naturally occurring fluoride in the drinking water exceeds 0.5ppm.
- ***Health promotion***: Health promotion activities such as advocacy, facilitation, education may be necessary for the initiation, implementation, acceptance and continuation of fluoride strategies.

NATIONAL FLUORIDATION STRATEGIES

The beneficial effects of fluoride as a public health measure have been known for more than 50 years. There are at least 4 cariostatic mechanisms of fluoride (Shellis and Duckworth, 1994):

- Reduction in acid solubility of enamel: It inhibits demineralisation by lowering the critical pH for the dissolution of enamel.
- Remineralisation of early carious lesions: Presence of fluoride has been shown to promote the process of remineralisation and the healed site is more resistant to caries attack.
- Increase in the rate of post-eruptive enamel maturation: It involves the incorporation of fluoride into the enamel during enamel formation. The hydroxyl ion is substituted by the fluoride ion in the hydroxyapatite leading to the formation of larger fluorapatite crystals, which are less susceptible to acid dissolution.
- Inhibition of acid formation by plaque bacteria: Fluoride interrupts the metabolic cycle of the oral pathogenic bacteria, thus reducing their ability to metabolise the sugars and produce the acids, which cause dental caries.

Fluoride's predominant effect is post-eruptive and topical and its effectiveness as a therapeutic agent in the remineralisation process is enhanced by its continuous availability in low concentrations in the oral environment (Clarkson et al., 1996; Lynch, Navada and Walla, 2004).

The principle public health approaches for the enhancement of a fluoridated oral environment are water fluoridation, salt fluoridation, and fluoride toothpaste. Other forms of fluoride such as fluoride mouth rinses, gels and varnishes are also effective (Marinho et al., 2002b,2002c,2003). However, they are accessible to a smaller population and depend on access to oral health care services. A limited number of randomised control studies on milk fluoridation show that it is effective in reducing dental caries in the deciduous as well as permanent dentition (Yeung et al., 2005) but fluoridated milk is generally limited to children in preschool, kindergarten or early school years with access to organised milk distribution. The key features of these methods are well documented in textbooks (Fejerskov et al., 1996; Murray et al., 1991; Murray et al., 2003;), systematic reviews (Marinho et al, 2002a, 2004; McDonagh et al, 2000a; McDonagh et al, 2000b; Twetman et al., 2003; Ammari et al., 2003), recommendations and technical reports (United States Department of Health and Human Services Centers for Disease Contol and Prevention, 2001; Estupinan-Day, 2005; Meyer and Marthaler, 2005; WHO, 1994; FDI, 1994; Jones et al., 2005). Currently, there are no systematic reviews on salt fluoridation. It is recommended that no more than one form of systemic fluoride be available along with fluoride toothpaste. The combination of various fluoride modalities is partially additive in terms of effectiveness (Marthaler, 1990).

SYNOPSIS OF FLUORIDE INFORMATION BASED ON CRITERIA

It is desirable for decision makers using FIT to access and review relevant scientific literature on the various fluoride vehicles in order to compare information. However, in many low-income countries access to scientific literature is limited. Therefore, a synopsis of the information on water, salt and toothpaste, categorised according to criteria, is provided in the following section.

Equitable

Water fluoridation is suitable for urban populations with a central water supply accessible to most of the population while salt fluoridation is more suitable for countries with large rural populations or regions with poor centralised water systems (Horowitz, 2000). Since water fluoridation reaches all subjects in a city or community which it supplies, it has the ability to reduce caries in all age groups, genders and socio-economic groups and to reduce socio-economic inequities in caries experience (Carmichael et al., 1980; Ellwood and O'Mullane, 1995; Slade et al., 1996; McDonagh et al, 2000a; McDonagh et al, 2000b).

Salt fluoridation has the potential to reach entire populations but a substantial part of the population may be using non-fluoridated salt depending on local legislation concerning the availability and usage of fluoridated and non-fluoridated salt. Approximately 80-100% of the population have access to fluoridated salt in Jamaica, Costa Rica, Mexico, Uruguay, Switzerland, Colombia and Ecuador. However, other countries such as France, Czech Republic, Slovakia, Spain and Austria have less than 30% of the population using fluoride salt. When fluoridated salt is packaged in 500 g or 1 kg packages and when it is permitted to be used in large kitchens, schools, bakeries and institutions as well as individual households, almost all the population is covered (Marthaler, 2005). Children's fluoride intake is less than optimum when their access is limited to table salt only (Hetzer et al., 1994). In order to obtain substantial public health benefits, it has been hypothesised that 75-85% of the population need to use fluoridated salt (Marthaler, 2005). In El Salvador and Bolivia where national salt fluoridation programes have been implemented, variations in caries prevalence are attributable to geographic and socioeconomic differences (Estupinan-Day, 2005).

The public health effectiveness of fluoride toothpaste is dependent on the uptake and regular widespread use (75% of the population) of an efficacious product (Renson, 1985; Nadanovsky and Sheiham, 1995). All social classes can benefit from the introduction of fluoride toothpaste. In the United Kingdom all social classes have benefited from the introduction of fluoride toothpaste, with the higher social class more than those of lower social class (Steel and Lader, 2003). Urban populations compared to rural are more likely to adopt brushing with a fluoride toothpaste in low-income countries (Varenne et al., 2004; Zhu et al., 2003).

Effective

Water fluoridated to 1ppm F in temperate climates and 0.5-0.7 ppm F in hotter climates has demonstrated cariostatic effects on the dentition of children as young as 3 years (Booth et al., 1992) and adults up to 75 years (Hunt et al., 1989). Analysis of 59 water fluoridation studies on the primary dentition and 86 studies on the permanent dentition, showed caries reduction in the order of 40-49% in the primary dentition and 50-59% in the permanent dentition (Murray et al., 1991). A systematic review of water fluoridation which included 214 studies of low or moderate quality, found the reductions in the incidence of caries to be lower than previously reported. The range (median) of mean difference in the proportion of caries-free children was -5.0% to 65% (14.6%); while the range (median) of mean difference in dmft/DMFT was 0.5 to 4.4 (2.25) teeth (McDonagh et al., 2000b). It has been estimated that water fluoridation reduces coronal and root caries over a lifetime by 20-40% (Newbrun, 1989) and reduces the percentage of edentulous (O'Mullane and Whelton, 1992).

An analysis of epidemiological information on the cariostatic effectiveness of salt fluoridation has led to the conclusion that for pre-school and school age children as well as for adults up to age 47 years, salt fluoridation affords a level of protection similar to that of water fluoridation when salt is fluoridated to 250 mgF/kg salt under the conditions of universal fluoridation (Marthaler, 2005). Early community salt fluoridation controlled trials in Hungary between 1966 and 1976 (Toth, 1978), and in Columbia between 1964 and 1972 (Mejia, 1986) demonstrated the effectiveness of fluoridated salt as a preventive measure for children when all salt for human consumption was fluoridated. In Hungary the dmft in children 2-6-years of age dropped 65.8% and in children 12-14-years of age, the DMFT reduction was 59% while little change was experienced in the control communities. Similarly, in 3 experimental communities in Columbia, the DMFT reduction was in the order of 48-60% in children age 6-14 years while the DMFT of the children of the control community remained stable over the period of 8 years. The dmft of the Columbian children age 2-7-years also showed progressive decline during the period of salt fluoridation. In the last two decades large declines in the 12-year-old DMFT has occurred in Jamaica (84% in 11 years), Costa Rica (73% in 13 years), Mexico (45% in 9 years) and Uruguay (42% in 8 years) (Estupinan-Day, 2005). Other factors such as the use of fluoride toothpaste have contributed to the caries reductions, as well the broad availability and usage of fluoride salt.

Brushing with a fluoride toothpaste is an ideal method to maintain an ambient level of fluoride in the oral cavity. Most clinical trials of fluoride toothpaste have been conducted with 1000 ppm of fluoride, either as 0.76 per cent sodium monofluorophosphate, 0.24 per cent sodium fluoride or 0.4 per cent stannous fluoride. Higher levels of fluoride above 1000 ppm have demonstrated proportional cariostatic efficacy (Stephen et al., 1988). For every additional 500ppm above 1000 ppm F, a cumulative 6-7% in caries increment can be expected. A systematic review of the effectiveness of fluoride toothpaste for the prevention of dental caries in children examined 74 included randomised controlled trials and found on average a 24% reduction in decayed, missing and filled tooth surfaces (D(M)FS) in the permanent dentition of children between the age of 6 to 16 years

(Marinho et al., 2002a). The effect of fluoride toothpaste increased with higher baseline levels of D(M)FS, higher fluoride concentration, higher frequency of use, and supervised brushing, but was not influenced by exposure to water fluoridation. No significant differences were found between the trials of sodium monofluorophosphate, stannous fluoride, sodium fluoride, and amine fluoride as the active ingredient. Similar conclusions were derived from another systematic review on the effectiveness of fluoride toothpaste (Twetman et al., 2003). A randomised controlled study of affordable fluoride toothpaste containing 1000 mg/kg of fluoride involving 2141 children age 6 to 10 years was conducted in the developing country of Indonesia (Adyamatka et al., 1998). After 3 years the children receiving the intervention experienced a 23% reduction in the DMFT increment compared to the control group, with the children under the age of 8 years experiencing a 40% reduction in the DMFT increment.

Fluoride toothpaste has also demonstrated caries prophylactic effects on the deciduous dentition. A large study involving 2008 children age 6 to 9 years reported a substantial reduction in caries increment (37%) which was highly statistically significant ($p < 0.001$) (Cahen, 1982).

Toothpaste at 1000 ppm of fluoride was found to have beneficial effects on adult coronal caries as well as root caries (Jensen and Kohout, 1998) and in another study, dentrifice containing 5000 ppm of F was significantly better at remineralising root caries than 1000 ppm fluoride toothpaste (Baysan et al., 2001).

Low fluoride toothpaste (250 ppm F) was found not to be as effective as toothpaste fluoridated to 1000 ppm F or more in a systematic review (Ammari et al., 2003). The anticaries efficacy of 500 ppm F toothpaste versus 1000 ppm F toothpaste requires further study. A randomised controlled study of 440 ppm F and 1450 ppm F toothpaste on a large study population showed a statistical difference in effectiveness in favour of toothpaste fluoridated at 1450 ppm F (Ellwood et al., 2004).

The lower reported reductions in caries for fluoride toothpaste compared to water and salt fluoridation may be attributed to the short duration of fluoride toothpaste studies (2-3 years). Regular lifetime usage of fluoride toothpaste may accrue the same benefit as water and salt fluoridation (United States Department of Health and Human Services Centers for Disease Contol and Prevention, 2001).

Efficient and Sustainable

Of the 3 fluoride interventions, salt fluoridation incurs the lowest cost and is the most efficient in terms of cost-benefit. The cost of the salt fluoridation scheme is dependent primarily on the number of factories available in a country.

With regards to infrastructure costs for salt fluoridation, a simple batch mixer with a motorised rotary paddle or ribbon mixer can cost US$3,000 to US$10,000 (Milner, 2000) and produce 2,000 to 3,000 tons a year for a population of 350,000 to 500,000.

Continuous spray machines can cost US$85,000 for a one ton machine to $US400,000 for a 5 ton/hr mixer and produce 20,000 tons/year for populations of several million people (Gillespie and Marthaler, 2005). The cost of installation for large plants can be as high as US$200,000. Approximately 85-90% of the costs are devoted to infrastructure. In many cases salt iodisation may already be in place in which case the cost of fluoride equipment would then be 30-50% less. The running costs of salt fluoridation (laboratory personnel, fluoride, maintenance) of which the major expense is the cost of the fluoride chemical, has been estimated to range from US$0.023 to US$0.04/capita/year.

Annual running cost per person for water fluoridation has been estimated to be US$2.94 for small communities (<5000 people) to US$0.46 for large communities with populations exceeding 20,000 (Griffin, Jones and Tomar, 2001). The running costs of fluoridation of salt are 10-100 times lower than that of water fluoridation. The amount of fluoride required for water fluoridation is approximately 100 greater than for salt fluoridation which increases the cost of shipping and storage. There is no literature on the cost of fluoridation equipment for water treatment plants.

Griffin, Jones and Tomar (2001) estimated the cost-benefit ratio (amount saved in restorative treatment for every dollar spent on the intervention) of water fluoridation for a large community to range from 1:3 to 1:34. Since salt fluoridation is 10-100 times less to run than water fluoridation, the cost-benefits of salt fluoridation would range from 1:30 to 1:300. Estupinan-Day (2000) reported a cost-benefit ratio range of 1:122 to 1:203 for salt fluoridation.

Toothpaste production is a fairly simple process which involves mixing the ingredients, usually fluoride, sorbitol, calcium, carrageenan, flavours saccharin and preservatives in a mixer. A highly automated production line cleans, fills, heat seals and boxes the tubes of paste. Workers would then seal four or six boxes together. An assembly line of 5 workers producing 57 tubes per minute, 16 hours per day, six days a week will yield 15 million tubes of toothpaste a year (Coughlan and Illes, 2003). A single filling line would cost US$200,000 while a mixer costs US$60,000.

In the Philippines the average 100 ml tube of toothpaste costs approximately US$0.27 to manufacture. Packaging accounts for 40% of this cost, ingredients comprise 40% and labour 20% (Coughlan and Illes, 2003). The retail price per 100 ml tube can range from US$0.40 to US$0.90 with a retail margin of 10% and distributor margin of 12.5%; with the gross margin varying from 15% to 62%. All the costs are passed onto the consumer.

The cost of toothpaste varies from community to community within countries and also from country to country. It may be relatively more affordable for consumers of high- and middle-income countries to purchase fluoride toothpaste than consumers in low-income nations. In many countries, toothpaste is taxed as a cosmetic product and governments are urged to remove taxes on fluoride toothpaste (WHO, 1994) and certain criteria should be developed to ensure the toothpaste is a quality product and that the savings are passed onto the consumer. Other strategies for increasing the affordability of fluoride toothpaste include:

- Advocacy to increase local manufacturing and distribution of fluoride toothpaste (Yee, McDonald and Walker, 2003).
- Social marketing of fluoride toothpaste (Decroix and Courtel, 2002).
- National or public production of fluoride toothpaste (Quattara and Varenne, 2002)

Due to the higher cost of fluoride toothpaste compared to salt and water fluoridation, the cost-benefit ratio would be less even when the assumption is made that fluoride toothpaste is as effective as the other interventions. A cost-benefit comparison of fluoride toothpaste and fluoride salt in Europe showed that for each $Euro spent on fluoride toothpaste 0.67 teeth are saved while the same amount spent on fluoridated salt saves 4.5 teeth (Marthaler and Pollack, 2005).

Safety

The toxicity of fluoride is dependent on the type of fluoride compound ingested. The more soluble inorganic fluorides (e.g. sodium fluoride) are more toxic than the less soluble (e.g. calcium fluoride). The lethal dose of sodium fluoride for an average adult has been estimated to be between 5 and 10 grams (32-64 mg fluoride/kg body weight) with the acute toxic dose of 5 mg fluoride/kg body weight (Whitford, 1996).

Fluorine is a halogen has been found to be compatible with iodine, another halogen; and fluorine does not potentiate the consequences of iodine deficiency in populations with borderline or low iodine intake, nor does fluorine have any effect on thyroglobulin content of the thyroid gland (Siebenhuner, Miloni and Burgi, 1984; Burgi, Siebenhuner, and Miloni, 1984).

When fluoridated to the recommended levels, ingested fluoridated water, salt and toothpaste have no ill effects on general health. In order for an adult to suffer from acute toxicity from water fluoridated at 1 ppm F, 800 litres of water would have to be consumed at one sitting. In order for an adult to suffer from acute toxicity 5 kg. of salt fluoridated at 380 ppm of fluoride would have to be consumed in a short period of time (Marthaler, 1983). Death would be due to over consumption of sodium and chloride, rather than fluoride. For severe dental fluorosis and crippling skeletal fluorosis to occur, a daily average of 53 grams of fluoridated salt (380 ppm F) corresponding to a daily intake of 20 mg. of fluoride would have to be ingested for decades. Iodine and fluoride can be safely combined to produce double fortified salt. The probable toxic doses of various fluoride agents used in dentistry has been quantified (Monsour and Kruger, 1985). A 5-year-old child (18.5kg) would encounter acute toxicity from consuming 87.6 grams of 0.8% monosodiumfluorophosphate (MSFP) toothpaste.

Since the amount of fluoride compound required for salt fluoridation is less than that for water fluoridation, industrial accidents and exposure to pollutants are minimised.

A recent systematic review of water fluoridation did not find any adverse health effects associated with water fluoridation (McDonagh et al., 2000b). There are no trends in cancer risk (Hoover et al., 1991), no impairment of immune function (Challacombe, 1996), and no increase risk of bone fractures (Phipps et al, 2000) associated with a level of safe water fluoridation.

With greater exposure to fluorides there has been an increase in the prevalence of dental fluorosis in both fluoridated and non-fluoridated communities (Whelton et al., 2004; United States Department of Health and Human Services Centers for Disease Control and Prevention, 2001). The York Review of 88 studies reported the prevalence of aesthetically important fluorosis in water fluoridated areas to be 10% and 6% in non-fluoridated areas (McDonagh et al., 2000b). Significant factors associated with enamel fluorosis in fluoridated areas include the age when brushing commenced, frequency of brushing, fluoride concentration of toothpaste, amount of toothpaste applied to brush and subsequently swallowed (Rock and Sabietha, 1997; Lalumandier and Rozier, 1995); and inappropriate fluoride supplement use (Pendrys et al., 1994). In nonfluoridated areas, the age whence brushing commenced (Lalumandier and Rozier, 1995) and inappropriate fluoride supplementation are the associated risk factors (Pendrys et al., 1996). The prevalence of fluorosis is high in some countries which have salt fluoridation and has been explained by the existence of communities exposed to both salt fluoridation and natural fluoride in water (Estupinan-Day, 2005). Prevalence of dental fluorosis is low in Switzerland where salt fluoridation schemes have been in place for 50 years and may be due to the widespread use of low fluoride toothpaste (250 ppm F) since its introduction in 1986 (Menghini, 2005).

In hotter climates the fluoride concentration in water has to be adjusted to 0.5- 0.7 ppm of fluoride to reduce the risk of dental fluorosis. Costa Rica permits marketing of fluoridated salt only in communities with water fluoride concentrations less than 0.3 ppm F and in France fluoride salt is permitted when the fluoride concentration in water is no higher than 0.5 ppm F (Tramini, 2005). Risk of acute fluoride toxicity and dental fluorosis associated with the use of fluoride toothpastes can be minimised by keeping the toothpaste out of the reach of young children, supervision of brushing, use of a pea-sized quantity of fluoride toothpaste and encouraging young children to spit after brushing. Fluoride supplements are only recommended for use by children who are at high risk to caries and live in areas with water fluoride concentrations less than 0.3 ppm F (Riordan, 1993).

Compliance

When water is fluoridated, the population receiving the piped water benefit without any change of behaviour. In some cities non-fluoride water is made available at the water treatment plant for individuals who wish not to consume fluoridated water. Consumers drinking bottled water or using a water filtration system in their homes may receive less than the maximum benefits of community water fluoridation (Toumba, Levy and Curzon, 1994; Flaitz, Hill and Hicks, 1989). In countries with fluoridated salt, consumers are offered the choice of both fluoride and non-fluoride salt and have the additional freedom to use little or no salt. In countries where brushing with a toothpaste is a normal everyday habit, education of the consumer to choose a fluoride toothpaste, to brush twice a day and for parents to brush their young children's teeth or supervise their brushing, are necessary in order to reap the benefits of fluoride toothpaste. Special compliance regimens are not required for children in the case of water or salt fluoridation. Appropriate use of fluoride toothpaste requires more diligence than use of either fluoride salt or water.

Feasible

All 3 fluoride approaches require adequate infrastructure, storage, quality control and distribution systems for the addition of fluoride to the vehicle. Water fluoridation is feasible if a centralised water system is available. Fluoride toothpaste is feasible when the manufacturing ingredients are readily available and when there is a market for fluoride toothpaste. Feasibility of salt fluoridation must also consider the sources of salt, grain size of salt, humidity, other additives; the country's current salt supply; geographic location of salt plants; population's salt consumption pattern; technology adopted by salt industry; size of salt plants; number of facilities required to provide fluoride salt for a particular proportion of the population; costs and social factors (Estupinan-Day, 2005; Marthaler and Petersen, 2005).

Legislation

In order to implement salt and water fluoridation programmes, local and national legislation may be necessary. The standards and legislation for salt fluoridation are more extensive than for water fluoridation and may include (Estupinan-Day, 2005):

- the type of fluoride and range of fluoride concentration permitted for addition to salt
- type of salt which may be fluoridated (table salt, use in baking and food production and restaurants)
- warnings and labelling of packaging
- regulations and specifications for imported salt
- specifications for quality control and monitoring by a institution or agency
- analytical method for quality control
- monitoring reports which need to be submitted by the salt plant
- safety regulations for salt plant workers

Special legislation is not required for the introduction fluoride toothpaste; however, many countries and trade organisations have standards for toothpaste based mainly on ISO Standard 11609 for Toothpaste (ISO, 1995) or on European standards. However, ISO Standard 11609 for Toothpaste has no minimum fluoride concentration for toothpaste in order for it to be classified as fluoride toothpaste and it does not contain safety standards for use of fluoride toothpaste by young children. Since the quality of fluoride toothpaste in developing countries is questionable (van Loveren et al., 2005), government standards and monitoring of the quality of fluoride toothpaste is advisable.

Quality Control

In many countries, the chemicals used for water fluoridation: sodium fluoride, sodium fluorosilicate and fluorosilicic acid; chemicals used in salt fluoridation: sodium fluoride, potassium fluoride and potassium fluoride anhydrous; and fluorides used in toothpaste: sodium fluoride and monosodiumfluorophosphate (MSFP) must meet the national standards for chemicals. Other countries depend on the producer to 'self-monitor' at the production plant or water treatment plant. In the case of salt and toothpaste fluoridation, collection of samples and analysis of fluoride dosage is also recommended at the point of sale. Accurate analysis depends on quality control personnel being trained to conduct the tests properly and a good monitoring system.

The potentiometric method with a specific fluoride electrode which is simple, accurate and relatively low priced is widely used for assessing fluoride in water, salt and toothpaste (WHO, 1999; Trachsel 2005). European guidelines recommend the more expensive gas chromatographic method for measuring the free ionisable fluoride in toothpaste. ISO Standard 11609 for Toothpaste (ISO, 1995) has no recommended method for measuring free ionisable fluoride and the described method measures only total fluoride. The free ionised fluoride in sodium fluoride toothpaste can be measured using the potentiometric method but for SMFP toothpaste, the MFP molecule must be hydrolysed to obtain free ionised fluoride (van Loveren et al, 2005). Free ionisable fluoride should not be less than 700 ppm F at the end of the expiry date.

Monitoring and Surveillance

Epidemiological surveillance of fluoridation programmes requires regular chemical and biological monitoring to evaluate fluoride intake and its impact. Children at age 6, 12, and 15-years should be examined for dentition status and fluorosis at baseline and at various stages of the fluoridation programme. Monitoring and surveillance for salt fluoridation is more extensive and in addition to the above, the additional recommendations are made (Estupinan-Day, 2005):

- monitoring of fluoride exposure by renal excretion analysis (Marthaler and Schulte, 2005) or fingernail clippings (Whitford, 2005)
- continuous monitoring of fluoride concentration in drinking water
- nutritional status of preschoolers
- monitoring and marketing of other fluoride products such as toothpaste, fluoride drops and tablets
- monitoring of fluoride concentration in salt at the plant, distribution network, warehouses, and points of sale
- monitoring the sale and distribution of fluoride and non-fluoride salt

For toothpaste fluoridation, monitoring of sales and distribution of fluoride and non-fluoride toothpaste is also recommended.

Application in High Fluoride Areas

The introduction of fluoride water or the distribution of fluoridated salt to communities where the water fluoride level is 0.5ppm F or more is not recommended in order to minimise the risk of fluorosis (Horowitz, 2000; Estupinan-Day, 2005). Use of fluoride toothpaste is not advised in locations with excessive fluoride intake (Mathaler and Petersen, 2005). However, the primary effect of fluoride toothpaste is topical and if there is compliance with safety instructions for the usage of fluoride toothpaste by young children, it would be reasonable to presume that fluoride toothpaste may be distributed in these areas.

Health Promotion

All preventive strategies require a health promotion approach to ensure their acceptance, implementation and effectiveness. The implementation of the fluoride strategy requires a multi-sectoral approach and cooperation amongst stakeholders, government and non-government organisations, industry and politicians. Education programmes are necessary not only for the general public but also for health care providers, public health personnel, politicians, decision makers and operators in salt, water or toothpaste manufacturing plants on a continual basis to reinforce understanding and to attain acceptance of the fluoride strategy. Anti-fluoride groups have focused their attention mostly on water fluoridation and less on salt fluoridation and fluoride toothpaste. Probably the most acceptable fluoride strategy is fluoride toothpaste. The use of fluoride toothpaste twice daily promotes oral self care and fluoride toothpaste with antimicrobials can also improve periodontal health (van der Ouderaa, 1991; Peter, Nayak, Philip and Bijlani, 2004). The promotion of salt or water fluoridation also obligates the promotion of brushing twice a day with fluoride toothpaste in order to reduce plaque and gingivitis. The cost of promoting the use of fluoride toothpaste is borne almost exclusively by the toothpaste manufacturers while other governmental and non-government agencies need to budget for the promotion of salt or water fluoridation.

FLUORIDE INTERVENTION TEMPLATE (FIT) FORM

Criteria #1:	Criteria #4:
Criteria #2:	Criteria #5:
Criteria #3:	Criteria #6:
Criteria #7	Criteria #8
Criteria #9	Criteria #10

Fluoride Intervention	**Criteria** In the parentheses below C1, C2, C3, etc., record the weights. Multiply the weight by the score for each intervention and all criteria.										**Total score**
	C1 ( )	C2 ( )	C3 ( )	C4 ( )	C5 ( )	C6 ( )	C7 ( )	C8 ( )	C9 ( )	C10 ( )	
Water fluoridation											
Salt fluoridation											
Fluoride dentrifices											
Total score											

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