Minamata Convention on Mercury: Developing Economies can 'Leapfrog' to mercury free 21st Century Dentistry.

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Introduction

Tooth decay (dental caries) is one of the most prevalent diseases with 91% of adults experiencing caries in their lifetime[1] and dental amalgam is usually the commonest restoration of choice for posterior teeth in developing countries. It has been estimated that 40% of children have tooth decay by the time they reach kindergarten[2].

The Minamata convention was adopted in 2013 in Japan. This agreement entered into force on 16th August 2017. The main objective was "to protect human health and the environment- from anthropogenic emissions and releases of mercury and mercury compounds[3]. In Part II of the Convention's Annex A, parties are to take measures to phase down the use of dental amalgam (45-55% mercury).

As stated in the Convention's preamble, this includes awareness "of health concerns, especially in developing countries resulting from exposure to mercury of vulnerable populations, especially women, children and future generations[3]. Measures to be taken by a party to phase down the use of dental amalgam shall take into account the party's domestic circumstances and relevant international guidance[3].

At the international workshop on the Minamata convention on mercury in Bangkok, Thailand in 2018, phase down efforts were refocused on dental education and vulnerable groups (children 1 - 17years) and women of child bearing age 15 - 39years[4].

The 3rd conference of the parties of the Minamata convention on mercury was held in November, 2020 in Geneva, Switzerland. After a vigorous debate the meeting directed parties (signatories) to accelerate the phase down of dental amalgam [5].

This paper will propose a unique accelerated phase down strategy for developing economies with weak infrastructures for handling wastes generally and mercury wastes in particular.

'Leapfrogging' strategy for phase down of dental amalgam for developing economies.

'Leapfrogging' phase down of dental amalgam means accelerated transition to mercury free 21st century dentistry with biomimetic, biocompatible tooth-colored long-term restorative materials (high viscosity glass ionomer cements, bisphenol free hybrid composite resin materials long term restoratives and Compomers) without widespread installation of amalgam separators and other costly mercury waste treatment technologies[6].

Developing economies typically have poor resources and technology for handling wastes generally and mercury wastes in particular[7].

Amalgam separators are expensive to procure and maintain[6,7]. Furthermore amalgam separators cannot handle mercury vapor[8]. Therefore, there will be continuous emission from the clinics with consequent exposure of staff, patients and patient relations[8].

In many developing economies there are no organized systems for sorting, transporting and managing mercury wastes from dental practices[6,7].

Mercury from dental clinics will therefore continue to pollute the soil and underground water system with consequent ingestion by fishes and other aquatic animals which man depends on as a source of food[6,7].

Strategic steps for 'Leapfrogging' to mercury free 21st century dentistry for developing economies

Developing economies can leapfrog' to mercury free 21st century dentistry by implementing the following five strategic steps:

I. **Adopt a time table, Update dental school curricula and simulation laboratories**:

   a. Adopt a timetable for the non-use of dental amalgam for vulnerable groups (children (1-17 years) and women of child bearing age (15-39 years);

b. Update dental school curricula to train future generation of dentists and private practitioners in mercury-free 21st century dentistry;

c. Upgrade the simulation laboratories of dental faculties with modern ICT compliant Professor/lecturer/students' simulation stations and immersive virtual and augmented reality technology (eg EON XR virtual + augmented + merged reality immersive e- learning technology) for effective delivery of experiential hands-on E-learning for both students and general dental practitioners in the present unpredictable COVID-19 pandemic era and beyond. This agnostic digital technology has been reported to have the following advantages when compared directly with traditional classroom and e learning platforms (eg google meet, zoom etc.)[11]:

- students are four times faster to train than in the classroom;
- students are 275% more confident to apply the skills learned; and
- students are four times more focused than their e-learning pears.

II. Adopt the World Health Organization's Basic Package for Oral Care (BPOC) and educate consumers.

a. Integrate the WHO BPOC into all programs and promotions of Primary Healthcare at all levels of government (Federal, State, Local and Community).

b. Educate consumers and parents that dental amalgam is half mercury (45-55%) and that non-toxic tooth coloured long term restoratives are better[10].

III. Modify government programs and Insurance coverage.

a. Modify government programs to favour mercury-free 21 century dentistry alternatives;

b. Modify insurance coverage to favour mercury-free 21st century dentistry alternatives (high viscosity glass ionomers, bisphenol free hybrid composites and compomers);

c. Promote the non-use of amalgam in stand-alone healthcare delivery systems such as hospitals and the armed forces.

IV. Stop the inflow of amalgam and reduce or remove import duty and taxes

a. Stop the inflow of dental amalgam from other countries and donor agencies.

b. Reduce or Remove import duty and taxes on long term 21st century restoratives - high viscosity glass ionomer restoratives, hybrid bisphenol free composite restoratives and compomers.

V. Integrate BPOC and an Integration, Prevention, Promotion and Partnerships (IPPP) framework into their national oral health Policies.

Developing economies as a matter of urgency should update their oral health policies to integrate the World Health Organizations' (WHO) basic package of oral care (BPOC) at all levels of healthcare (primary, secondary and tertiary levels) as well as at all levels of government (Federal, State, Local Government and Community). **-(Fig. 1).**

National oral health policies should be re-focused on Integration, Prevention, Promotion and Partnerships (IPPP) **(Fig. 1).** The atraumatic restorative treatment (ART) developed by Prof JE Frencken in Africa is a component of BPOC. The restorative material recommended for ART is high viscosity glass ionomer long term restoratives (e.g Fuji IX). The BPOC/ART is recommended by WHO for underserved communities. Poverty should not be an excuse to place dental amalgam in under-served communities and further expose them to environmental hazards. This is a very important consideration in sub-Saharan Africa where the UNEP and WHO reported a higher percentage of diseases traced to environmental pollution (35%) compared to 25% world-wide[12].

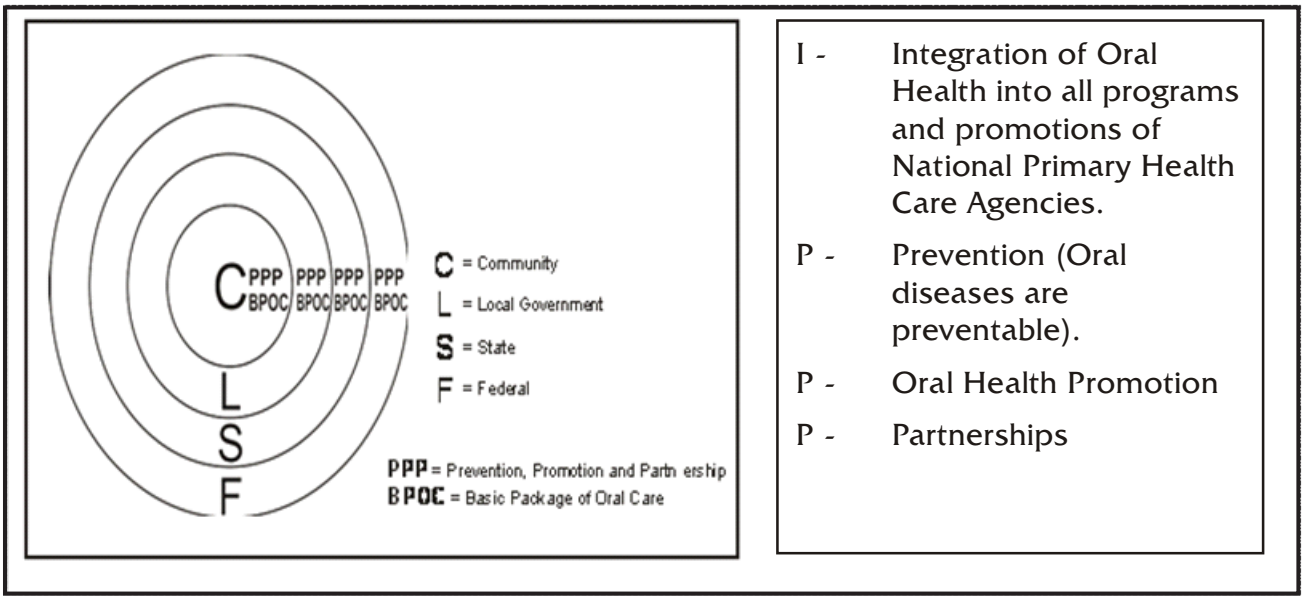

Fig.1: The proposed I.P.P.P. policy framework for update of National Oral Health Policies in Developing Economies to 'leapfrog' to 21st century mercury free dentistry. (NPHCDA=National Primary Heath Care Development Agency).

Dental mercury waste generated during the transition period.

In the transitional phase down period, developing economies should quickly develop and implement a policy for collection, sorting, transport and storage of dental mercury wastes generated. These wastes can be exported to countries with the requisite technology to treat them. International donor agencies should be co-opted into this transitional period phase down arrangements.

Developing economies should as a matter of urgency adopt and implement the above strategies in order to accelerate phase down of dental amalgam and safe guard their environment and the health of their citizens.

Ironically, most of the dental amalgam manufacturers are in developed economies. They should therefore be encouraged and supported (possibly with a'Minamata Marshall plan') to switch their factories to making biocompatible mercury free long term restoratives (high viscocity glass ionomer restoratives, bisphenol free composites and compomers)

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