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Update of Oral Health Policy to Implement the Children's Amendment to the Minamata Convention on Mercury (COP 4.2)

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ABSTRACT

This paper reviewed the slow but steady progress made worldwide to implement the provisions of the Minamata convention on mercury as agreed at the Conference of the parties (COP 3.0, 4.1, 4.2 and 5.0). We proposed a unique 'leapfrogging' strategy- update of oral health policy as a cost-effective strategy for African countries and other developing economies. This strategy could also be adopted by developed economies with underserved communities as well as developed economies who desire to safe costs. The cornerstones of this strategy include update of dental training institutions curricula, review of health insurance policies, integration of the principles of minimum intervention dentistry (MID) into oral health policies with an integration-prevention-promotion-partnerships ('II-PPP') framework with the WHO Basic Package for Oral Care. We hope this approach will enhance the speedy implementation of the children's amendment particularly in Africa and other developing economies with poor infrastructure for managing waste.

Keywords

Minamata Convention on Mercury, Children's Amendment, COP 4.2, Mercury-free dentistry, Dental amalgam phase-down.

Introduction

Environmental experts involved in arctic research were the first to draw global attention to the increasing concentration of mercury in the air, land and sea [1]. The devastating consequences of mercury pollution in Minamata, a Japanese industrial city highlighted the need to have a legally binding agreement. The Minamata Convention on mercury is a global treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. Presently there are 149 countries who have ratified the convention (signatories) 44 European, 43 African, 36 Asian and 26 Latin America and Caribbean countries [2]. Initial efforts were focused on industrial processes that use mercury -the cement industry, oil and gas etc. It was later realized that there are other common products that contain mercury (eg light bulbs, sphygmanometer, dental amalgam etc.). The convention immediately fixed a date to phase out the use of such materials except dental amalgam which was placed on a progressive phase down strategy. This was because it was realized that there will be need to retrain dental professionals on the use of alternatives. In addition, there was opposition by Dentists and Dental professional associations who believed there was no better substitute to Dental Amalgam despite its well-known human and environmental toxicity [3,4]. Progress continued to be made worldwide in the effort to phase down and eventually phase out

dental amalgam. Implementation of its provisions in Africa and other developing economies have been slow because of scarce resources, continuing resistance from dental professionals and a sub-optimal collaboration between the focal points (Ministries of Environment) and other stakeholders (particularly ministries of health, education, trade and industries, justice, women affairs and dental training institutions etc.).

This paper will propose a unique cost-effective strategy to "leapfrog" the implementation of the children's amendment to the Minamata convention on mercury (COP 4.2) in Africa and other developing economies.

Worldwide Move to Phase Down and Phase Out Dental Amalgam

Alliance for a cavity free future (ACFF), International Association for Dental Research (IADR) and Colgate Palmolive, Cape Town, South Africa- Figure 1.

Figure 1: Chris Hall, Colgate Palm Olive Director for East and West Africa, welcoming Deans from Nigeria to the Workshop delivered by Prof Nigel Pitts (UK) and Amid Ismail (USA) in Cape Town, South Africa (June 2014).

On 24th June, 2014, in Cape Town, South Africa, during the International Association of Dental Research (IADR) conference, Colgate Palm Olive and The Alliance for a Cavity Free Future (ACFF) invited all Deans in Nigeria to a one-day workshop on current (21st century dentistry) scientific reports on the etiology and management of dental caries. The major take home message was the need for dental faculties to develop or adopt a 21st century evidence based cariology curriculum that will incorporate the principles of minimum intervention dentistry (MID). Shortly thereafter, African Countries met in Abuja and declared that Africa will be the first continent to be mercury free to prevent the dumping of dental amalgam on the continent as was experienced with lead paints. (Abuja Declaration) [5].

World Alliance for Mercury Free Dentistry (WAMFD) and the United Nations Environmental Program (UNEP) Workshop, Bangkok, Thailand -Figure 2.

Figure 2: Participants from 25 countries at the UNEP/WAMFD workshop in Bangkok, Thailand in May 2018 UNEP -United Nations Environmental Program WAMFD -World Alliance for Mercury Free Dentistry.

In May 2018 The World Alliance for Mercury Free Dentistry (WAMFD) and the United Nations Environmental Program (UNEP) organized a 2-day workshop in Bangkok, Thailand titled 'Promoting dental amalgam phase down measures under the Minamata Convention and other initiatives, for especially women, children and through them future generations.' There was a special focus on updating dental school's curricula in Africa and other developing economies [1]. The African group discussion panel identified eight deliverables for implementation [1]:

1. Update of dental school curricula to train dentists in mercury-free dentistry instead of amalgam;
2. Educate consumers and parents that amalgam is half mercury and that non-toxic alternatives exist;
3. Modify insurance coverage to favor mercury-free alternatives.
4. Modify government programs to favor mercury-free alternatives.
5. Adopt a timetable for the non-use of amalgam for children.
6. Adopt a timetable for the non-use of amalgam for pregnant and breastfeeding women.
7. Promote the non-use of amalgam in stand-alone healthcare delivery systems such as hospitals and the armed forces etc.
8. Stop the inflow of amalgam from other countries and/or donor agencies.

UNEP and C OP 3.0

The United Nations Environmental Program (UNEP) in May 2021 released a significant scientific report on the human toxicity of mercury titled 'Gender, equity and mercury'. This publication highlighted the significant adverse effect of mercury on children and women of child bearing age. This publication sponsored by Sweden reported the following profound findings [6]:

- Association with low iq and autism
- Neurotoxity in children and adults

- Infertility and preterm births
- Endocrine and neuro-developmental disorders.

The 3rd conference of the parties held in Geneva, Switzerland directed parties to accelerate the phase down of dental amalgam by implementing more than two of the seven steps to phase down the use of dental amalgam [7].

The Federal Drugs Administration (FDA)

In 2024 the Federal Drugs Administration (FDA) in USA released a public advisory restricting the use of dental amalgam in vulnerable populations [8]:

- Pregnant women and their developing fetuses.
- Women who are planning to become pregnant.
- Nursing women and their newborns and infants.
- Children, especially those younger than six years of age.
- People with pre-existing neurological disease.
- People with impaired kidney function.
- People with known heightened sensitivity (allergy) to mercury or other components (silver, copper, tin) of dental amalgam.

However, the International Association of Oral Medicine and Toxicology (IAOMT) pointed out that more than 60 % of the US population will be negatively impacted by the continued use of dental amalgam. The associated then submitted 'If it is not good for more than 60% of the population, why use it at all!' [9].

COP4.1 (Virtual COP) and WHO submission

During the virtual COP 4.1 held in Geneva Switzerland, the WHO after wide consultations with public health and dental experts globally, submitted a paper which supported the phase down of dental amalgam and the principles of minimum intervention dentistry (MID) by explicitly stating that [10]; "Phase down and even phase-out of the use of dental amalgam is achievable. At the country level, national policy makers have both the ability and the will to implement measures recommended by the Minamata Convention, and effective, costeffective and simple-to-use mercury-free alternatives to dental amalgam are increasingly available' The WHO further submitted that:'The phase down process has the potential to be accelerated by further strengthening multisectoral leadership and collaboration, as well as establishing clear timelines to achieve the nine phase-down measures. To facilitate this process at the global and regional levels, it is critical to increase support to low-income countries and other countries which have severe funding and resource limitations and a high prevalence of untreated dental caries. Through such comprehensive, stepwise, and inclusive initiatives, most of the countries can accelerate the phase-down in use of dental amalgam and make critical progress in reducing risks and better protecting our environment and human health.'

COP4.2 Bali, Indonesia

In 2022 at the COP 4.2 meeting in Bali, Indonesia, the Conference of the parties agreed as follows [11]:

1. Parties shall no longer allow the use of dental amalgam for the dental treatment of children under 15 years (or according to national definition of childhood age) and of pregnant and breast-feeding women, except when deemed strictly necessary by the dental practitioner based on the specific medical needs of the patient.
2. Parties shall ensure that dental amalgam is only used in the pre-dosed encapsulated form and no longer allow the use of mercury in bulk form by dental practitioners.
3. parties shall ensure that waste contaminated with dental amalgam from operators of dental facilities in which dental amalgam is used or dental amalgam fillings or teeth containing such fillings are removed, are managed in an environmentally sound manner.
4. Parties shall set out or update their national plan concerning the measures they intend to implement to phase down or phase out the use of dental amalgam. Parties shall make such plans publicly available and submit such to the secretariat of the Minamata convention by 31st December, 2024. The secretariat shall compile and present a comparison paper demonstrating progress towards the objectives of the Convention and make such available to parties six months in advance the next conference of the parties.

The WHO also released in march 2021 a public health advisory titled 'Prevention and treatment of dental caries with mercury-free products and minimal intervention.' This publication highlighted four advantages of minimum intervention dentistry/atraumatic restorative treatment (MID/ART) [12]:

1. MID/ART avoid unnecessary pain, infection and permanent damage to the teeth while preventing and treating dental caries.
2. MID/ART does not generate aerosols which is particularly beneficial when there is concern about possible airborne transmission of illness such as during the COVID-19 pandemic.
3. ART can be applied by a trained dental therapist, dental nurse, dental hygienist using glass ionomer cement (long term restorative-e.g. Fuji IX); and
4. ART is less invasive and does not require extensive dental training, so treatment can be provided through the primary health care system.

The European Union (EU)

On September 22nd, 2023, 41 African NGOs through the World Alliance for a Mercury Free World (WAMFW) submitted a petition to the EU through Hon. Marlene Mortler (MEP) urging EU to ban the manufacture and export of dental amalgam from its territory [13]. It is noteworthy that on 8th February 2024 the EU council voted overwhelmingly (98%) to ban the use of dental amalgam for dental treatment from 1st January 2025 except when deemed strictly necessary by the dental practitioner based on

specific medical needs of the patient [14]. The council also banned the export of dental amalgam from its territory from the same date. Furthermore, the EU council banned the import and manufacture of dental amalgam from its territory from 1st July 2026 [14]. This noteworthy decision by the EU should encourage Africa and developing economies to leapfrog the implementation of the children's amendment to the Minamata Convention on mercury as decided at COP 4.2

Constraints to Implementation in Africa/Developing Economies

The main constraints for the implementation of the decision reached at COP 4.2 in Africa and other developing economies are limited resources and suboptimal collaboration between stakeholders. With several seminars, webinars and conferences held from 2014 to date to promote mercury free dentistry in Africa, Dentists in Africa and other developing economies are gradually embracing 21st century mercury free dentistry (minimum intervention dentistry -MID) [15]. The financial mechanisms of the Minamata convention should be enhanced and refocused on updating the knowledge and skills of future generations of Dentists and other dental professionals (Dental therapists, Hygienists, Nurses and Dental Surgery Assistants in these countries in the principles of minimum intervention dentistry (MID). Special provisions should be introduced into the financial mechanisms of the convention to support update of dental school's curricula and workshops for general dental practitioners [16,17].

Strategies to phase down/phase out dental amalgam for Africa and Developing Economies.

'Leapfrogging' dental amalgam phase down strategy simply means accelerated phase down of dental amalgam without widespread installation of amalgam separators and other costly mercury treatment technologies [18]. Developing economies typically have poor resources and technology for handling wastes [18]. Amalgam separators are expensive to procure and maintain. Furthermore amalgam separators cannot separate or remove mercury vapor [19]. Therefore, there will be continuous emission from the clinics with consequent exposure to staff, patients and patient relations [18,19]. In many developing economies there are no organized systems for sorting, transport and treatment of mercury wastes generated by dental practices [18]. Mercury from Dental clinics will therefore continue to pollute the air, soil and underground water system with consequent ingestion by fishes and other aquatic animals which man depend on as a source of food [1]. Mercury from these clinics will also contribute to soil pollution with potential to adversely affect agriculture and wild life [1]. However, there should still be provision for limited installation of amalgam separators in teaching and specialist centers and a protocol for collection, sorting and transport of mercury wastes generated during the phase down period should be developed [1]. Africa and other developing economies should plan to acquire the requisite waste handling technologies [18].

The following five strategic steps have been carefully selected from relevant literature to leapfrog Africa and other developing economies to mercury free 21st century dentistry: [16,18]

1. Draw up an action plan, adopt a timetable for the country and educate the public.
2. Update dental school's curricula with the principles of Minimum intervention dentistry (MID) and upgrade dental school's simulation laboratories with advanced (artificial intelligence enhanced) e-learning technology. This will enhance undergraduate and postgraduate education and the re-training of general dental practitioners through online webinars, workshops, symposia and conferences.
3. Integrate the principles of minimum intervention dentistry (MID) into oral health policy by adopting an integration-prevention, promotion and partnerships' focused oral health policy update framework ('II-PPP').
4. Modify Insurance coverage and government programs.
5. Stop the inflow of amalgam and reduce or remove import duty and taxes on mercury free restoratives (high viscosity Glass Ionomer restoratives, Composites and Compomers).

Guiding Principles of a 21st Century Oral Health Policy-Minimum Intervention Dentistry (MID)

At the European festival of oral science held in Cardiff, Wales, UK in 2002, Dan Ericson, Edwina Kid, Dorothy McComb, Ivan Mjor and Michael J Novak outlined the principles of the emerging philosophy of minimally invasive dentistry (MID). The authors highlighted the five principles of MID as consisting of: [20]

i. Accurate diagnosis of risk, disease and lesions.
ii. Primary prevention.
iii. 'Just in time' restoration.
iv. Minimally invasive operative procedures and
v. Secondary prevention.

Mjor and Eriksen in 2008 espoused one of the far-sighted principles of MID: "The decision to place the first restoration in a previously unrestored surface of a tooth is a crucial event in the life of a tooth, because a permanent restoration in the true sense of the term permanent does not exist" [21]

Another cornerstone principle of MID is the preference for repair rather than replacement of defective restorations. Reports by Gordan et al. [22-24] and Moncada et al. [25] highlighted the following advantages of repair:

i. Maintenance of the restorations original form thereby reducing or eliminating stress of the tooth.
ii. Damage to adjacent teeth is avoided.
iii. Repair prevents postoperative sensitivity because of re-exposure of dentinal tubules and
iv. Repair avoids more complex restorations.

The challenge had been how to implement the new principles

in dental practice and in dental education particularly in poor developing countries with significant populations of under-served communities.

Tyas [26,27] defined minimal intervention dentistry as an approach to the management of dental caries with the aim of minimizing the loss of tooth structure by disease or by iatrogenic intervention. Tyas further submitted that the aim of MID is to keep all teeth healthy and functional for life and specified the following five strategies to achieve this objective:

i. Early caries detection and risk assessment.
ii. Optimal caries preventive measures (both in the clinic and at home).
iii. Remineralization of demineralized enamel and dentine.
iv. Minimally invasive operative intervention, and
v. Repair rather than replacement of defective restorations.

The guiding philosophy of MID is Ericson and Kidds' admonition that 'restorative treatment (of early caries lesions) should be delayed to provide maximum possibilities for natural lesion repair and arrest' [20,21].

GC Europe MID Advisory Board defined Minimum Intervention Dentistry as "a holistic, patient-centered, evidence-based approach to caries management with preservation of healthy tooth tissue" [28-30].

Domejean et al identified the six principles of MID as consisting of [28-30]

1. Early caries diagnosis and caries risk/activity assessment;
2. Prevention;
3. Re-mineralization of early caries lesions;
4. Minimally invasive operative techniques;
5. Repair of defective restorations; and
6. Patient education and motivation (Oral health promotion).

Frencken et al. [31] further reinforced Kidd's admonition by explicitly stating that the first three of Tyas et al.'s MID strategies (oral health maintenance-OHM) should be employed throughout a patients' lifetime and only when oral health maintenance has failed (cavitation) should minimum operative intervention be employed. He further submitted that prevention is the cornerstone of MID (21st century dentistry) because dental caries is a chronic multifactorial, behavioral, lifestyle disease that requires diet, lifestyle habit and behavioral changes to reduce risk factors. These principles of MID has also been applied in other dental disciplines (periodontology, oral rehabilitation and oral surgery etc.). This has led to the emergence of the new concept of minimum intervention oral care (MIOC) [32].

A 21st century oral health policy should be built on the cardinal principles of minimum intervention oral care anchored on an 'II-PPP-BPOC' oral health policy update framework to 'leapfrog' Africa and developing economies to mercury free 21st century dentistry [17,33]. There is no scientific support for the continued use of dental amalgam (an environmental pollutant and human health toxic material) as a restorative material in 21st century dentistry. Twenty first century dentistry is mercury free [34]. Dentists who continue to use dental amalgam and manufacturers and dealers who continue to trade it are exposing themselves to litigation by well-informed patients.

Update of Oral Health Policies-Twinning 'I-PPP' framework with WHO BPOC-Figures 3 and 4.

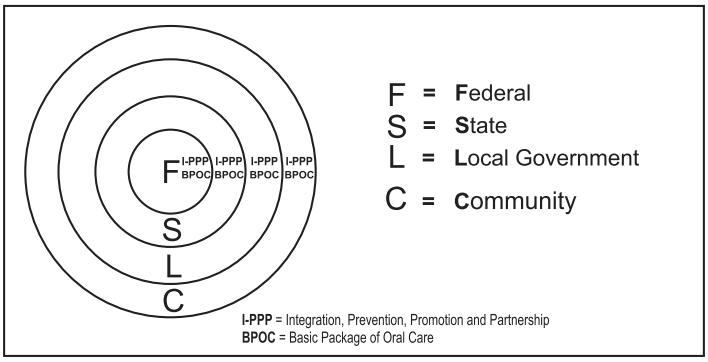

Figure 3: Illustrates the multilevel "twinning" of I-PPP oral health policy framework with WHO BPOC at all levels of healthcare 1, 2, 3. (Note) ART (Atraumatic Restorative Treatment) is a component of BPOC at primary healthcare centers.

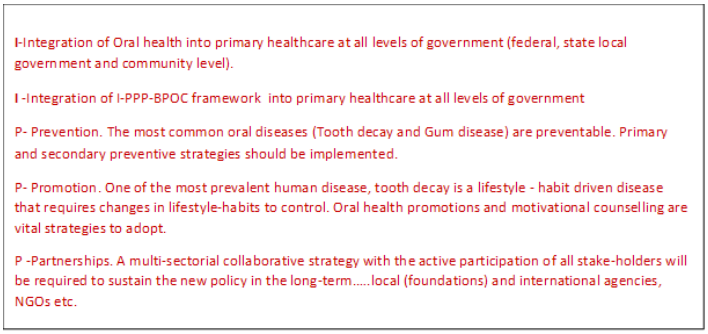

Figure 4: I-PPP- 21st Century Oral Health Policy Update cornerstones.

There is an urgent need to up-date Oral health policies in Africa and developing economies to integrate the WHO basic package for Oral care (BPOC) into all health plans and programs at all levels of healthcare (primary, secondary and tertiary levels) and all levels of governance (Community, Local, State and Federal) [17]. National oral health policies should be updated with focus on Integration, Prevention, Promotion and Partnerships with the integration of the World Health Organization recommended BPOC for underserved communities [17]. 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) [33]. Some scientific reports have reported short-term and long-term success of this material when directly compared with dental amalgam [35,36].

Other investigators have reported decreased microleakage, improved marginal seal, improved surface hardness and creep resistance after heat and ultrasonic excitation of high viscosity glass ionomer restoratives (Fuji IX) [37,38]. Manufacturers have been introducing new restoratives with enhanced properties (e.g. Acqua Forte by GC corporation Japan, Ketac molar by 3MESPEE, USA, Ionostar molar by Vocodent, Germany, ROK by SDI, Australia, Activa Bioactive by Pulpdent Corp., USA, Amalgomer by Advanced Dental Systems, UK) [34].

Structure, Finance, Staffing and Training [17] - Figure 5
Integration of II-PPP - BPOC framework into oral health policies will require that definitive structures be set up for management, finance and staffing of the framework at federal, state, local government and community levels (Figures 1, 2) [17]. In addition, the responsibilities of heads and coordinators of such a structure must be well defined (Figures 2, 3) [17]. As reported by Chher et al. [39] from Columbia critical elements for the success of such a program will include; regular supplies of dental instruments, basic infection control kits and a vibrant ICT technology enhanced monitoring and evaluation framework [17].

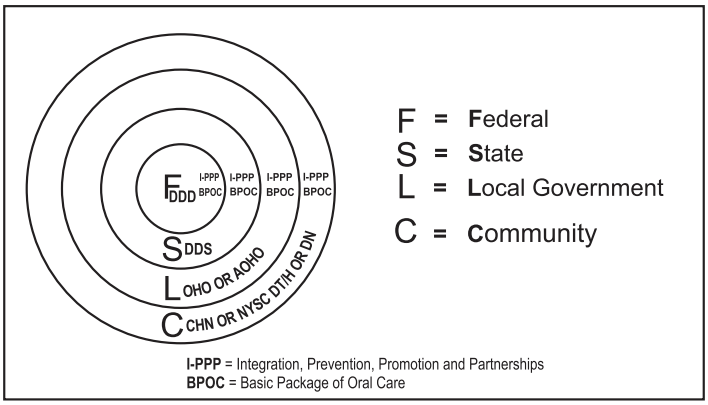

Figure 5: Illustrates the staffing requirements, responsible officers at the different levels of health care.
DDD = Director, Dental Division; DDS = Director, Dental Services; OHO = Oral Health Officer; AOHO = Assistant Oral Health Officer; CHN = Community Health Nurses; DT/H = Dental Therapist / Hygienist; DN = Dental Nurses.

At the federal level, the Director of Dental Division should have overall control and supervision of the policy with responsibilities for: budgeting, multilevel –seamless coordination and communication, logistics for consumables and instruments, monitoring, coordination and evaluation, development or adoption of technology for seamless reporting, monitoring and evaluation and research into its effectiveness [17].

At the state level, the Director of Dental Services will have responsibilities for statewide supervision of the program at local government and community levels, monitoring, documentation, evaluation of the outcome, filing of reports to the federal headquarters, training of primary healthcare nurses, seamless communication with the federal, local government and community oral healthcare workforce, documentation, reporting, monitoring and evaluation of the outcome [17].

In addition, the state director should be responsible for direct supervision of regional training centers for Dental Therapists/ Hygienists/Dental Surgery Assistants, Comm. Health Nurses and other healthcare personnel in ART/BPOC/basic infection control, Universal Health Coverage, Workforce 2030 etc. [17]. At the local government level Dentists or Dental therapists or dental nurses (when dental manpower is suboptimal), should directly monitor and supervise the oral care services and workforce at the primary healthcare centers and file reports to the state director of Dental Services [17]. The WHO Action plan advocated that oral health prevention programs should be integrated /combined with other chronic disease prevention and educational programs and policies. This should also include all child and maternal health programs [40]. Figure 6.

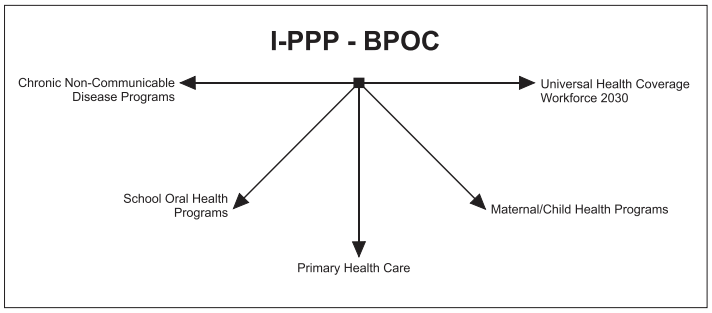

Figure 6: Proposed integration of the Twinned I-PPP – BPOC oral health policy framework into other health care programs and promotions.

Handling Mercury Wastes Generated During the Phase Down Period

It should be noted however, that a 'leapfrogging' phase down strategy does not preclude the installation of amalgam separators in designated teaching and regional specialist hospitals, where the necessary additional equipment required for safe removal of dental amalgam, when necessary, can be safely performed with reduced risk of exposure to mercury vapor. Adequate provisions should also be made for safe collection, sorting, transport, storage and treatment of mercury wastes generated during the phase down period. These wastes can be exported to countries with the requisite technology to treat them. *International donor agencies should be co-opted into this transitional phase down period arrangements* [18]. Ironically, most of the dental amalgam manufacturers are in developed and emerging economies (Europe, Australia, India and Brazil). Such manufacturers should be encouraged and supported (perhaps with a "Minamata Marshall Plan' –'MMP') to switch their factories to making biocompatible mercury free long-term restoratives (high viscosity glass ionomer restoratives, bisphenol free composites, and compomers) [18].

Conclusion

'Leapfrogging' to mercury free 21st century dentistry is a feasible, desirable and achievable strategy to adopt for Africa and other developing economies with poor infrastructure for managing

wastes. It can also be adopted by developed economies with underserved communities as well as developed economies who desire to save costs. The top priorities should include update of dental training institution's curricula; retraining of general dental practitioners through workshops, conferences, and webinars; update of health insurance policy to favor mercury free restoratives and update of oral health policies with the 'II-PPP-BPOC' framework. Poverty should not be an excuse to continue the use of dental amalgam (45-55% mercury) in under-served communities and further compromise their well-being. This is a very important consideration in Sub-Saharan Africa where UNEP and WHO have reported a higher percentage (35%) of diseases traced to environmental pollution compared to 25% world-wide [41]

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