



## What is dental caries?

Dental caries is a biofilm-mediated, diet modulated, multifactorial, non-communicable, dynamic disease resulting in a net mineral loss of dental hard tissues. It is determined by biological, behavioural, psychosocial, and environmental factors. As a consequence of this process, a caries lesion develops.<sup>1</sup>

## What is a dental cavity?

A tooth with caries that has progressed far enough to produce a collapse in the integrity of the outer enamel, exposing the inner dentine. This stage of caries typically leads to a restoration or filling.<sup>2</sup>

## What is cavity-free?

Cavity-free implies that there are no detected cavities in dentine. However, thorough clinical examination may reveal the presence of non-cavitated and/or micro cavitated carious lesions.<sup>1</sup>

### *Suggested Citation:*

Pitts, N. & Mayne, C. (2021). *A Global Consensus for Achieving a Dental Cavity-Free Future*.

DOI: 10.18742/pub01-045

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The Consensus Recommendations contained in this report were co-created by the Task Force members over a series of meetings at the end of 2020. The remainder of the report has been written by the authors following the advice and suggestions of the Taskforce members. The authors take responsibility for the views expressed.



*This document is supported by a living appendix which can be accessed at [www.acffglobal.org/making-cavities-history](http://www.acffglobal.org/making-cavities-history)*

Summary documents, explanatory papers and case studies will be added to the appendix over time.

### Key Appendix Documents:

- An economic perspective on the global burden of caries
- Making Cavities History Taskforce Policy Recommendations

<sup>1</sup> Machiulskiene V. et al., Terminology of Dental Caries and Dental Caries Management: Consensus Report of a Workshop Organized by ORCA and Cariology Research Group of IADR. *Caries Res* 2020;54:7–14 (<https://doi.org/10.1159/000503309>).

<sup>2</sup> Pitts, N., Mazevet, M., Mayne, C., Hinrichs, S., Boulding, H., & Grant, J., Towards a Cavity-Free Future: How do we accelerate a policy shift towards increased resource allocation for caries prevention and control? The Policy Institute at King's, 2017, (<https://doi.org/10.18742/pub01-015>).

# Foreword

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Dental caries (tooth decay) is the most prevalent Non-Communicable Disease (NCD) globally and affects all age groups across the life course. Despite the accepted scientific evidence that caries (and the dental cavities it produces) create very significant personal, societal, and economic burdens across the world and that caries presents the largest numerical impact across oral health, the disease has typically been invisible in health policies. This situation appears to be paradoxical, as the burdens and pain caused by caries and cavities are preventable and addressing the risk factors for cavities can also reduce other NCDs and improve general health.

The good news is that, building on the developing global consensus amongst the dental, scientific, and public health communities that a Cavity-Free Future is both possible and desirable, we now appear to be at a unique point in time when many interests and opportunities align. After more than a decade of advocacy by many groups, it now seems possible to embark on global and local policies to reduce cavities and to improve not only oral health but also NCDs, as well as wider health and wellbeing. This paper and its consensus recommendations have been produced with the advice of a Taskforce of volunteers convened by the *Alliance for a Cavity-Free Future*<sup>3</sup>. These 35 individuals have a broad range of scientific, specialist and public health expertise across a diverse range of disciplines from a total of 20 countries. Together they have co-created a series of consensus policy recommendations

which, if implemented both globally and at the country level, will *Make Cavities History*. The timing of this paper is fortuitous as, in recent months, we have had two landmark publications from WHO. In late December 2020, a *WHO Director-General's report on oral health*<sup>4</sup> was published which identified opportunities to renew political commitment to oral health as part of WHO's NCDs and UHC agendas. In January 2021 the WHO 148th Executive Board considered and approved a draft *WHO 2021 oral health resolution*<sup>5</sup> (the first on oral health in 14 years). The resolution calls 'to reorient the traditional curative approach... move towards a preventive promotional approach with risk identification for timely, comprehensive and inclusive care, ... contributing to the improvement of the oral health of the population with a positive impact on overall health'.

This makes the *Taskforce for Making Cavities History's* call to action and policy recommendations on dental caries timely, and importantly these recommendations very much align with the emerging global agenda on improving oral health. They are also compatible with the agendas of the dental practice community (as outlined in the FDI World Dental Federation's Vision 2030)<sup>6</sup> and the dental science community (as outlined in the International Association for Dental Research's views on the Role of Research in the WHO Oral Health Resolution),<sup>7</sup> as well as the countries supporting the WHO Resolution and the wider supporting groups. We are optimistic that the appropriate inclusion of our consensus recommendations on caries and cavities within strategies and action plans globally and locally will accelerate progress towards *Making Cavities History*, as well as improving NCDs and wider health.



**Professor Nigel Pitts**  
Chair – ACFF Taskforce  
for Making Cavities History

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# Overview

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**Caries is the world's most prevalent non-communicable disease. Caries and cavities affect sufferers right across the life course, and globally are responsible for the largest burden of all disease.**

Untreated caries and cavities can adversely impact the quality of life of sufferers in multiple ways. In addition to this, untreated caries creates sizeable economic challenges with huge global costs. Caries is a widespread problem and has the largest impact of any issue within oral health, yet the burden and pain caused by caries and cavities are preventable.

By tackling caries at the early stages, we can avoid cavities. This can not only lead to improvements in oral health but can also, through common risk factors, go a long way towards tackling other major (and costly) non-communicable diseases for wider health benefits.

Despite this evidence, caries is typically ignored in health policy. Previous global policy recommendations have not explicitly mentioned dental caries, and caries is not currently visible in global or national NCD strategies. This means that it is invisible to health policymakers and does not come with available resources.

We can demonstrate that a cavity-free future is possible, and also widely desirable. With a shared international vision for this for the last decade, we are at a turning point, with dental authorities around the world united in this vision, speaking with one voice to push for change.

Making progress with caries requires both WHO-level global policy agreements and country-level policy implementation. With this in mind, the ACFF Taskforce was formed to bring together world-leading experts in cariology, behaviour change, public health, and health policy, in order to create consensus on policy recommendations. This is in order

to ensure international level agreement and buy-in, as well as locally suitable frameworks for initiating effective policy and healthcare systems development.

The key outcomes of the Taskforce were that population education and behaviour must drive change around primary NCD prevention, with caries recognised in global and national NCD agendas. It is also critical to tackle sugar and the other major food risk factors for NCDs, whilst continuing to educate people on the importance of nutrition and hygiene. To move to a cavity-free future, there also needs to be integrated and incentivised primary and secondary caries prevention across the life course as part of wider health provision. We also need to push to ensure the availability of systematic surveillance data to monitor actions and progress.

**The recommendations within this paper are a consensus among international representatives from across the global dental community. The authors strongly believe that if a concerted, global effort is made, dental caries can be stopped in its tracks, and we call upon policymakers to consider these recommendations so that we might feasibly create a future free from dental cavities.**

Everything discussed in this paper is based on best evidence. This evidence should be shared broadly throughout institutional, healthcare professional, industrial, civil society, and patient communities so that all can play their role as the world embarks with greater determination on the path to a cavity-free future.

# Introduction: Dental caries and cavities

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**Dental caries is a biofilm-mediated, diet modulated, multifactorial, non-communicable, dynamic disease resulting in a net mineral loss of dental hard tissues. It is determined by biological, behavioural, psychosocial, and environmental factors. As a consequence of this process, a caries lesion develops.<sup>1</sup>**

*The international consensus for the scientific definition of caries is set out above; a range of lay and other definitions are provided in the glossary.*

Bacteria in the mouth create a biofilm that attaches to the teeth, known as dental plaque. This plaque creates acids as a by-product of their metabolism of carbohydrates, which in turn causes demineralisation in the teeth. The mouth is home to a complex balance of microbiota (the microbiome) which, when healthy, allows for the remineralisation of the teeth at an equal rate, keeping the teeth in a healthy cycle. The health of the microbiome and the teeth can be aided and maintained by ensuring caries control measures are undertaken, including restriction of sugar and the adoption of effective and regular oral hygiene routines including exposure to fluoride, which aids in the remineralisation process.<sup>8,9</sup>

The caries disease process is triggered when, due to low-pH conditions within areas of the mouth, the balance between the demineralisation and remineralisation at specific tooth sites shifts, resulting in sustained demineralisation of tooth structure, leading to the creation of caries lesions. This change in condition may be a result of excessive dietary sugar intake, ineffective oral hygiene, or suboptimal exposure to fluoride.

Caries lesions that are left unmanaged may progress in severity to eventually produce a collapse in the integrity of the outer enamel, exposing the inner dentine. This is commonly



**“The caries disease process is triggered when, due to low-pH conditions within areas of the mouth, the balance between the demineralisation and remineralisation at specific tooth sites shifts, resulting in sustained demineralisation of tooth structure, leading to the creation of caries lesions.”**

known as a dental 'cavity'. Caries which has reached this stage typically leads to a restoration (or filling) when dental services are available.

Caries which has reached the cavity stage imposes a significant burden on society, both in terms of quality of life and economic losses. The monetary costs lie not only in the direct costs associated with initial and repeated surgical treatment but also in indirect costs due to loss of work or school productivity due to pain.

**The tragedy of caries is that the pain, suffering, and costs caused are largely preventable.<sup>8,9</sup> To continue to delay or avoid a more decisive shift towards 'preventive dental medicine'<sup>10,11</sup> is no longer acceptable and stakeholders must now move to support the evolution of caries management to allow for a focus on measures**

**that prevent and arrest caries development and preserve natural tooth structure whenever possible, with the aim of reducing caries burden and making cavities history.**

As we progress, it is key to note that our mission to make cavities history does not expect that dental caries will be completely eradicated. As a non-communicable, multi-factorial complex disease process, this could be an impossible task. However, as the early stages of the caries process can be arrested and sometimes reversed, with appropriate processes in place dental caries need never lead to dental cavities. Therefore, it is not unrealistic to suggest that a cavity-free future is possible.



# 1 – The ‘Global Burden’ of dental caries and cavities

**Dental caries is the world’s most prevalent, chronic, non-communicable disease (NCD), and the cavities resulting from untreated caries are amongst the most common unmet healthcare needs globally, afflicting over 2.8 billion people across the life course.<sup>12</sup>**



Untreated dental cavities in permanent teeth occurs in 2.4 billion people globally (35% of the global population),<sup>13</sup> and more than 530 million children (1/4 of all children) suffer from untreated dental cavities in the primary teeth.<sup>12</sup>

Caries is a disease that follows sufferers throughout the life course. Despite the incredibly high numbers of children still suffering from untreated caries, an ageing population with increasing levels of caries and cavities shows us that focus must also be put on ensuring caries risk is minimised for all age groups. Risk factors for caries shift slightly between age groups. For older people, other risk factors appear in addition to diet and hygiene. These include specific challenges around maintaining good oral hygiene, deterioration of old restorations, multiple medications, denture wearing and institutional living, and cavities

often increase due to comorbidities.<sup>14, 15</sup> The care needs of older, vulnerable populations therefore, differ from those of children and younger adults, and the need for person-centred care to be provided by a broad workforce has been identified as a feature of improving oral health in older generations.<sup>16</sup>

There is a distinct socio-economic variation in the distribution of caries and the need is particularly high amongst disadvantaged population groups.<sup>17</sup> The inequalities in the distribution of caries are apparent both at a country level and on a global scale. Populations can broadly be split into four categories: those who show high compliance for preventing caries, with lots of access to care; those who show high motivation but without much access to care; those who show low compliance despite having access to care; and finally, those who show low compliance and also do not have much access to care.<sup>2</sup>

**“Oral health is multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex.”<sup>18</sup>**

## 1.1 – Quality of life is adversely affected by caries and cavities

Untreated caries can lead to intense personal suffering from pain, tooth loss and infection, which in turn can affect the ability to eat, which can potentially stunt growth and development. Untreated caries is also a major cause of toothache<sup>8</sup> which is a prevalent condition even in more affluent countries; for example, in the most recent national dental survey of children in the UK, 18% of 12- and 15% of 15-year-olds reported suffering from toothache in the last three months.<sup>19</sup> A recent systematic review highlighted the strong association between toothache and poorer quality of life.<sup>20</sup> Furthermore, severe caries results globally in the hospitalisation of tens of thousands of people per year, predominantly children, for tooth removal, with risky general anaesthetics administered which can be the cause of further health complications.<sup>21</sup>

Even in countries where dental services are readily available, the perceived stigmatisation of poor oral health and dental caries not only causes suffering to those who experience it, but also can result in a decrease in care uptake, as patients are embarrassed to visit the dentist knowing that they require intervention. This results in a subsection of patients whose caries state continues to suffer unnecessarily, with treatment sought often only once later stage issues have become apparent. This is not only an issue due to patient embarrassment or fear, but is often seen due to financial concerns, with the cost of a routine dental visit being viewed as either undesirable or beyond the spending capacity of patients, who once again do not visit the dentist until preventive interventions are not sufficient solutions to their issues.

When left unmanaged, caries can cause negative long-term social and psychological effects for children and adults, which may be reflected in anxiety, lack of desire to smile or confidence in

communicating with others, all of which can severely affect people's quality of life. There is consistent evidence of the considerable negative impact of caries on the quality of life of child populations across different age groups and backgrounds<sup>22-24</sup> with impact increasing in line with disease severity.<sup>25</sup> Similarly, representative data showed that about one in four UK adults with untreated caries and more than one in three with severe caries reported both frequent and severe impacts on their quality of life<sup>26</sup> with further impact demonstrated amongst older adult groups.<sup>27</sup>

Poor oral health caused by caries can have significant impacts on all families, both financially and socially, as well as due to pain. This may be experienced in a variety of ways, such as the need for repeat dental visits and the need for potentially expensive restorative treatment, the embarrassment or guilt felt due to 'ineffective' home care, or potentially placing blame on family members for their oral hygiene or dietary habits. The impact of untreated caries on quality of life, along with the time required to access treatment, can result in both school and work hours being missed, causing negative effects not only for the patient but also for their employer. Historically, it was estimated that 1.57 million school days were lost in 1980 as a result of dental problems.<sup>28</sup> Two recent systematic reviews demonstrated through metanalyses that caries does indeed continue to have a significant influence on school performance and school attendance among children and adolescents.<sup>29, 30</sup>

The impact of caries on oral health-related quality of life (OHRQoL) has been clearly documented, however, the impact of caries goes beyond that which can be captured. A systematic review that looked at all oral conditions showed that only caries and tooth loss (which is often a result of caries) showed a negative impact when assessed using health-related quality of life measures.<sup>31</sup> Globally, untreated caries

accounted for almost 5 million disability-adjusted life years (DALYs) in 2010, with a further 4.5 million DALYs attributed to excessive tooth loss. Caries contributed to DALYs across the life course, more heavily for children and young adults, while tooth loss equally affected middle-aged and older adults.<sup>12</sup> A recent study using US nationally representative data documented the considerable impact of dental disease on quality-adjusted life expectancy (QALE) among US adults, showing that in particular decayed and missing teeth were associated with higher disutility in all age groups. To put this in context, dental conditions represent 5.3% in QALE due to overall morbidity, an estimate that is about one-third of the respective estimates for heart disease and obesity and one-quarter of the respective estimate for smoking and diabetes.<sup>32</sup> Despite the challenges faced in obtaining clear, useful figures, the extent of the health and social burden of caries is both quantifiable and substantial.

## 1.2 – Caries creates sizeable economic challenges

In addition to the health and social burdens, dental caries is also associated with an economic cost, stemming from the amount spent directly on treating the disease as well as on the indirect costs associated with lost productivity. The indirect costs include mainly lost productivity to the economy due to absenteeism/presenteeism at work.

At the time of publication, explicit data on the global annual economic burden of caries is not currently available. In the calculation of the true burden of caries, the direct burden incurred as a result of caries (treatment/restoration costs), which is estimated at 15% of the total oral disease burden<sup>7</sup> and also the close links

between untreated caries and tooth loss (a recent study estimated that 52% of tooth loss is directly attributed to untreated caries)<sup>33</sup> must be considered. Therefore, utilising best available data on these figures we have estimated that caries more likely accounts for 45% of the total burden of oral disease.<sup>i</sup> This estimate does not include any periodontal burden which may have been impacted by caries, therefore should be considered a lower bound estimate.



According to the most recent analysis available, the global economic cost of dental diseases is \$544 billion, with \$357 billion accounted for by direct costs of treatment and \$187 billion in productivity losses to the economy.<sup>34</sup> If we assume that 45% of this economic burden can be attributed to caries, the resulting estimate is a global economic burden of caries of \$245 billion. This includes an estimated \$161 billion in direct treatment costs for caries and an estimated \$84 billion in indirect productivity losses for caries.<sup>i</sup> To place this in context, diabetes, which is appropriately appointed significant policy attention, accounts for an estimated \$760 billion in global expenditure.<sup>35</sup>

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<sup>i</sup>These estimates are subject to limitations- for more information please see the appendix document 'An economic perspective on the global burden of dental caries'.



The lack of data available for comprehensive analysis highlights a distinct need for increased and improved research into the economic burden associated with caries. This is an area that must be addressed to ensure progress can be made towards accurately and effectively targeting caries within global and local health systems.

Local adaption must also always be centric to any attempt at creating a useful estimate of burden or cost-savings. Treatment costs vary widely between health systems, and the disease burden is far from equally spread. Whilst high-income countries see the lowest cases of untreated caries in both adults and children, middle-income countries see the highest rates across both,<sup>12</sup> meaning that the financial treatment burden will lay more heavily in these areas.

Despite the not-inconsiderable scale of the economic burden of caries, the availability of resource and capacity within health systems to develop, implement and evaluate alternative plans is often very limited. Prevention measures can prove cost effective<sup>36</sup> and economics

can offer an insight into the re-orientation of health systems towards prevention.<sup>37</sup> Whilst in some developed countries government-funded public health prevention measures such as water fluoridation have had a positive impact on caries levels, caries remains a major public health problem.

### **1.3 – Caries is the most common NCD and has the largest impact within oral health**

Dental caries affects people throughout the life course, from early childhood and adolescence, through adulthood, and into later life. Problems often start in childhood and follow sufferers throughout their lives. For sufferers, the disease may also get worse in later life, particularly when general health fails, and oral self-care becomes more difficult. Caries also occurs in parallel or in association with other oral and general health problems.

The prevalence and cyclical nature of caries as well as its tendency to follow sufferers throughout the life course leads to it causing a huge, unparalleled impact within oral health.

The Global Burden of Disease Study puts untreated cavities of permanent teeth as the number one most prevalent condition across 291 considered diseases, affecting 35% of the population across all ages.<sup>12</sup> Additionally, untreated caries in deciduous teeth is ranked at number ten.<sup>12</sup>

In comparison, severe periodontal disease comes in at number 6, affecting 10.8% of the population, or 743 million people,<sup>17</sup> with oral cancers, which are among the 15 most common cancers globally, registering 500,500 cases in 2018.<sup>38</sup> These numbers show that despite the relative lack of focus on caries and cavities from across the board, the collective impact of ignoring them is huge.

# 2 – The burden and pain caused by caries and cavities is preventable

**Despite the epidemic nature of the disease, it is widely acknowledged amongst the dental community that dental caries can be controlled, and that when public health, societal, individual and clinical preventive strategies are combined, cavities are preventable.** <sup>8, 9, 39-44</sup>

This therefore means that the economic, health, social and community burdens resulting from caries are wholly unnecessary, and that with the correct steps in place at personal, national and international levels, a health-focused, cavity-free future should be within our grasp.

## 2.1 – By tackling caries, we can avoid cavities

We do not need more evidence to show that preventing and managing dental caries is possible.<sup>2</sup> What is needed now is to align existing knowledge about the dynamic nature of dental caries with the application of effective measures to prevent and control the disease.<sup>39-44</sup> By getting to the complex core of effective caries care and management and working to rebuild dental education and health care systems in a way which is supportive of a health-focused, collaborative, inter-professional approach to dentistry, it is possible that we could see a significant decrease in the incidence of cavities, and with that a significant reduction in the burden associated with caries.<sup>2</sup>

## 2.2 – Preventing cavities will also tackle other NCDs and improve general health

The effective translation of this knowledge into action will not only decrease the prevalence of caries but also its associated common risk factors, improving both oral and general health across the life course, with benefits felt across the wider health agenda.

Caries shares common risk factors with other major and costly non-communicable diseases, such as obesity, diabetes and cardiovascular disease.<sup>45</sup> Frequency of sugar consumption<sup>46</sup> and poor hygiene are common issues which, when tackled, will have a positive impact on these and other wider health issues. This shows that caries is not a standalone issue and should be addressed in conjunction with wider oral and general health policy and care delivery to ensure maximum health benefit is achieved across the board (Fig. 1). The monitoring of shared risk factors is a key element of reaching NCD targets, and the expansion of monitoring programmes to include caries risk factors within the broader NCD framework should be a simple first step that will support both the caries and wider NCDs agendas.

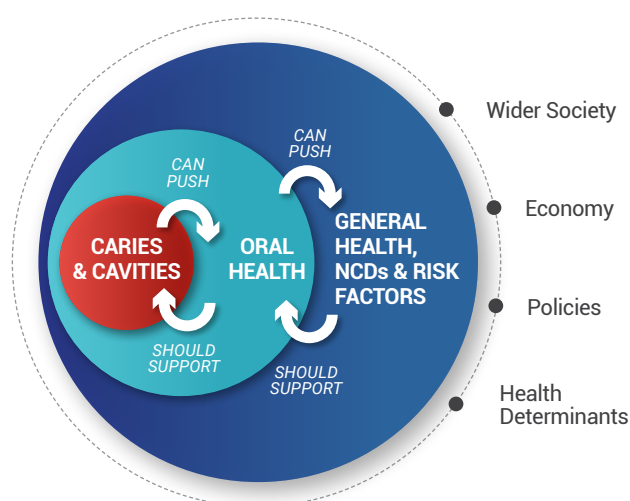


Figure 1 – Interrelationships between caries and cavities, oral health, and wider health

# 3 – Despite the evidence, caries is typically ignored in health policy

**Health is recognised as a precondition for and an outcome of sustainable human development and is the focus of Sustainable Development Goal (SDG) 3 in the 2030 Agenda adopted by the United Nations General Assembly.<sup>47</sup>**

As we have explored, oral health is an integral part of general health and wellbeing, and therefore it should be held together with general health as a basic human right. Despite this, there is no standardisation for the inclusion of caries in strategic planning and oral health remains largely absent from both global and national policy agendas. Where it is present, regardless of the sizeable impact caries has on oral health, policy discussions have largely overlooked caries and cavities as areas of prioritisation or focus. There has been no global political mandate for dental caries prevention and management, with the few previous oral health policy initiatives resulting in minimal action towards an improvement in caries.

## 3.1 – Previous global policy recommendations have not mentioned caries

Whilst successful WHO recommendations and resolutions have been included in the past in conjunction with NCD strategy,<sup>48</sup> diet,<sup>49</sup> health promotion and healthy lifestyles,<sup>50</sup> and healthy ageing,<sup>51</sup> there is little or no explicit mention of either oral health, or caries or cavities. However, the WHO Implementation manual 'Ending Childhood Dental Caries'<sup>52</sup> published in 2019 shows recognition of the importance of targeted intervention for the issue of caries which has, until this point, largely been unacknowledged.

Since 2015 the UN Sustainable Development Goals have been at the forefront of international policy development. SDG3 focuses on health,

committing governments to 'ensure healthy lives and promote well-being for all at all ages.'<sup>47</sup> Despite caries being identified as the most prevalent disease burden, and its sharing of common risk factors with others NCDs, it is not currently addressed within any of the recommendations.

## 3.2 – Caries is not visible in global or national NCD strategies

Due to the lack of supranational visibility, dental caries continues to remain absent in global and national NCD programmes despite its formal classification as an NCD<sup>53, 54</sup> and its common modifiable risk factors to other major and costly NCDs such as obesity, diabetes, and cardiovascular disease.

## 3.3 – Lack of visibility leads to lack of resources

A lack of policy-level prioritisation means that oral health, and specifically prevention of caries and cavities, are not universally present in strategic planning for health organisations, and have, until now, often been viewed as a side issue with underestimated direct and indirect costs for healthcare systems and the society.<sup>55</sup> The lack of focus on caries specifically results in an absence of mandated allocated resources to tackle the problem.<sup>2</sup> Whilst oral health budgets are decreasing and human resources are scarce, priority is given to more visible issues and caries, despite being preventable, is often left aside.



Caries prevention in practice is supported by evidence in Systematic Reviews<sup>56, 57</sup> as well as practice-based studies of preventive caries management.<sup>42-44</sup> Dental Policy Labs<sup>2, 58</sup> have concluded that we do not need more evidence before making policy changes in this area, although of course, we will need implementation science and continuing research to introduce and evaluate change effectively.

When a tooth enters the 'restorative spiral' (Fig. 2),<sup>59</sup> its care needs become more and more complex and expensive, resulting often in multiple replaced restorations of increasing severity with the affected tooth at each stage of the cycle reaching a significantly higher risk of eventual extraction.

Despite this knowledge, and some notable attempts to change, in many countries the balance of dental education remains largely focused on a surgical approach to dentistry, resulting in a workforce who are still often biased towards restorative rather than preventive intervention. The effective use of established methods of primary, secondary, and tertiary caries prevention allows the arresting of early-stage disease and prevent the initiation of new lesions, prior to the tooth requiring restoration.<sup>8, 9</sup> Achieving this successfully means that it is possible to prevent the development

of cavities and maintain tooth health. This pathway of prevention needs to be incentivised and prioritised to encourage practitioners to take a preventive approach to caries care, avoid the restorative spiral and minimise the long-term costs and risks to the tooth.

The pathway towards achieving effective preventive caries care moving towards the goal of a cavity-free future has been explored in the ACFF 'Dental Policy Lab' series. The need to incentivise primary and secondary prevention, as well as push for appropriate use of tertiary prevention and minimally interventive tooth-preserving care only when required, was identified as a key takeaway from the first Policy Lab session<sup>2</sup> and followed up as the focus of the second Lab, 'Towards paying for health in Dentistry'(Fig 3).<sup>58</sup> These multi-stakeholder policy development sessions (Fig. 4) outlined and explored the need for policies to allow for effective resource allocation to promote preventive care, and the creation and implementation of prevention-based dental payment systems to remunerate practitioners for prevention.

The third in the Dental Policy Lab series looked towards implementation and enabling public health, dental stakeholders as well as the oral health and dental industries to align with a preventive shift and promotion of positive

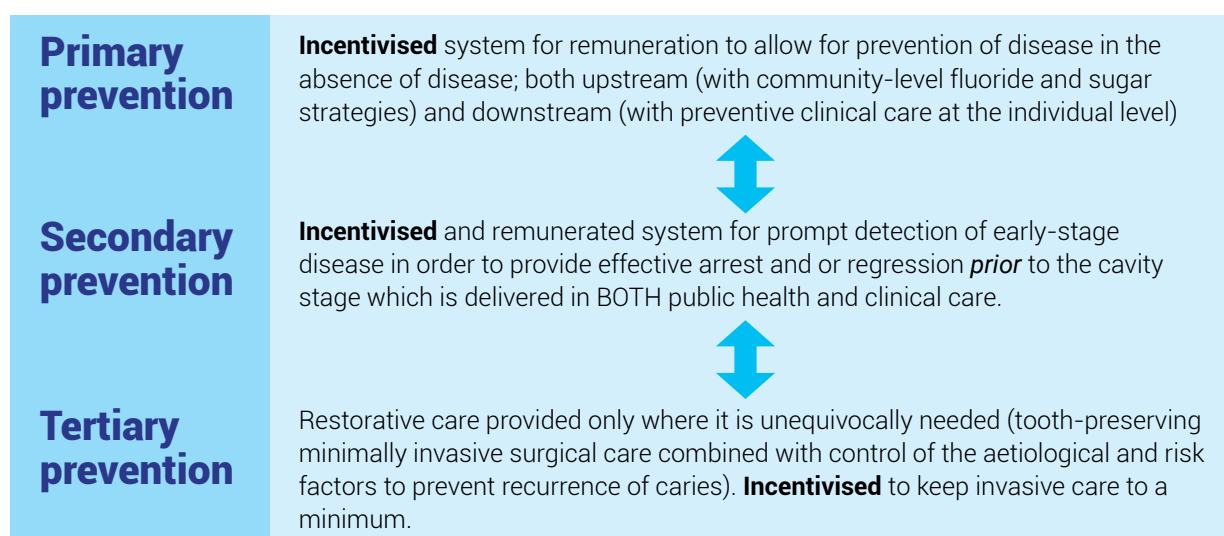


Figure 3 – 'Proposed integrated solution: 3-tiered preventive caries care'<sup>2</sup>

behaviour change in caries prevention and control.<sup>60</sup> These initiatives have prompted positive responses globally, and the foundations have been set for developing and implementing further recommendations towards achieving a cavity-free future within the wider context of also improving both oral and general health.

#### 4.1 – A decade of shared vision

Armed with the knowledge that cavities can be prevented, the dental community has been drawing up recommendations for decades on the most appropriate ways to prevent and manage dental caries.<sup>11, 61-67</sup> The International Association for Dental Research (IADR) has been working for over a decade through its Global Oral Health Inequalities Research Agenda having recognised the limited success in translating research into effective action to promote global oral health (including caries and cavities) and eliminate inequalities.<sup>68, 70</sup> They also signposted the need to integrate action with approaches to reduce the global burden of non-communicable diseases.

Since 2010, the Alliance for a Cavity-Free Future (ACFF) has acted as an enabling body and worked to support initiatives that push for developments in both clinical and public health level<sup>2, 69</sup> caries prevention and control around

the world. Mobilisation has been seen globally across six continents with organisations and multiple stakeholder groups pushing towards a shift in viewpoint on the issue of caries prevention and management. In recent years ACFF has been part of an overarching “Global Collaboratory for Caries Management” (GCCM). In this virtual collaborative network, King’s College London and its international partners work together with both the ACFF and the ICDAS Foundation, which is responsible for both the International Caries Classification and Management System (ICCMS™) and CariesCare International (CCI).

Achieving a cavity-free future requires a multi-sectoral approach, and the ACFF works to bring together these stakeholders in alignment towards creating a unified approach to tackling caries.

Societies, institutions, organisations, and charities have come together to research, develop best practice recommendations and find the best way to move forward leveraging all possible synergies. However, despite having access to the research and materials required to enable change, previous lack of political recognition of the problem, commitment and resource allocation has not yet allowed for sufficient tangible reductions in the prevalence or burden of caries.

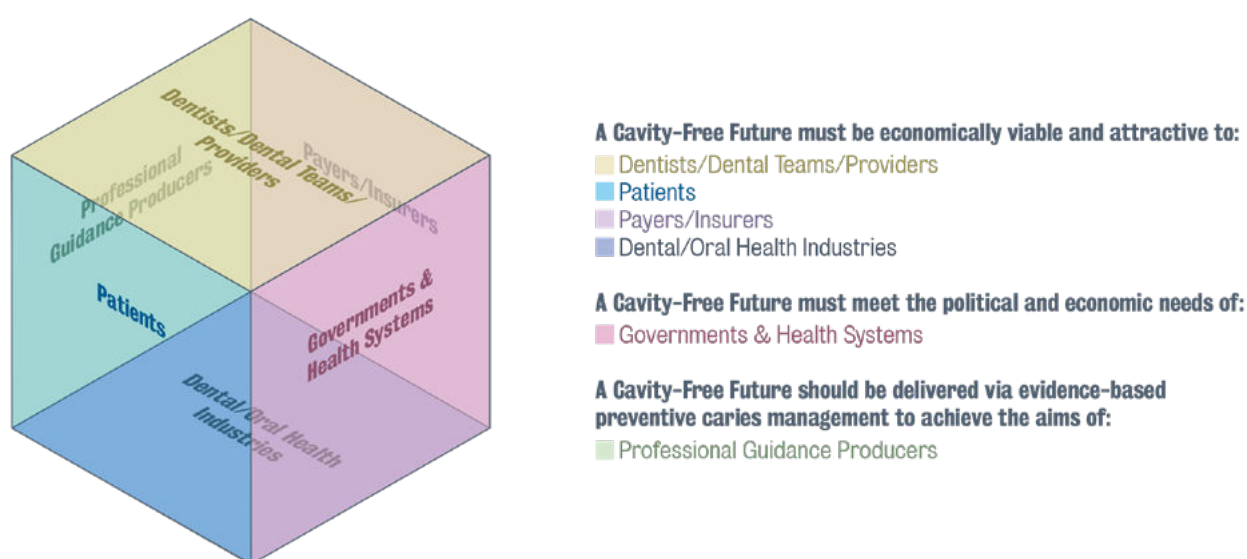


Figure 4 – The ‘Win6 Cube’ demonstrating stakeholder incentivisation

## 4.2 – A globally united approach

The last ten years have seen the building of an international network, bringing together those with a shared vision to work to address industry and policy, pushing forward the cavity-free agenda. The advocacy undertaken for the joining-up of caries prevention and minimally interventive clinical management has resulted in a widespread global acceptance of the need for delivering effective 'preventive dental medicine'.<sup>10, 11</sup> This approach is shared by the FDI World Dental Federation within their 'Vision 2030', and the dental research community.<sup>68, 70</sup> The alignment of global leading experts, global oral health institutions and the global dental community, combined with the current political climate offers a unique opportunity for us to see distinct progress in combatting caries and cavities. There is also agreement that, as we move forward with change, we ensure that Implementation Science can play a key role in understanding how the transformations needed happen in an optimal way and in evaluating whether the changes meet the stated objectives. The need for appropriate epidemiological, behavioural and other related translational research is also clear.<sup>7</sup>

## 4.3 – Building on existing policy drivers

Given the enduring health challenge posed by oral diseases, new initiatives have begun to rise to reignite interest and renew political commitment to oral health. There are many issues currently visible within the wider policy arena that align with aspects of the Making Cavities History proposals, making this a timely and important initiative.

### WHO Oral Health Resolution 2021

Following a recommendation to include an item on oral health in the provisional agenda of the WHO 148<sup>th</sup> Executive Board, a WHO Director-General's report on oral health was published in December 2020 outlining the enduring global health challenges posed by oral diseases.<sup>4</sup> This report identified opportunities to renew political commitment to oral health as part of WHO's NCDs and UHC agendas, thus contributing to

the achievement of the United Nations 2030 Agenda for Sustainable Development and SDG3. This report, and a draft resolution on oral health,<sup>5</sup> went before the WHO 148<sup>th</sup> Executive Board for consideration; the resolution was adopted. WHO Member States' commitment to strengthening and accelerating action on oral health offers a firm basis for further action to boost national and international oral health policy agendas, with actions centring around the different ways to reduce common risk factors, strengthen health system capacities, improve surveillance, data collection and monitoring while accelerating advocacy, leadership, and partnership.



The WHO 2021 oral health resolution calls **'to reorient the traditional curative approach, which is basically pathogenic, and move towards a preventive promotional approach with risk identification for timely, comprehensive and inclusive care, taking into account all stakeholders in contributing to the improvement of the oral health of the population with a positive impact on overall health.'**<sup>5</sup> This makes our call for action timely, and important in aligning with a global agenda on improving oral health. The inclusion of caries and cavities within the WHO Strategy and Action Plan for achieving this change will accelerate progress and ensure that priority is given to the areas such as caries and cavities in which the greatest impact can be seen.

## Universal Health Coverage

Universal Health Coverage has been included as one of the targets of the Sustainable Development Goals (SDG3.8) and has been described as ‘the single most powerful concept that public health has to offer’.<sup>71</sup>

In September 2019, the United Nations High-Level Meeting on UHC officially acknowledged oral health as being a part of the UHC agenda.<sup>54</sup> This recognition by the UN of the enormous burden of oral health is a fantastic and timely opportunity, despite the complexities and challenges of effective integration.<sup>6</sup> The FDI will be instrumental in ensuring that oral health be embedded within UHC strategies at a country level. The WHO definition of UHC states that all people should have access to ‘the full range of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care.’<sup>72</sup> Effective primary and secondary oral prevention within primary care and UHC is the foundation of ensuring that all people have the opportunity to remain cavity-free. The commitment to ensure that through UHC, all people can access dental preventive services should ensure that caries prevention and management be viewed as a basic requirement within the design of health systems so that improvements can be seen not only in oral but in general health.

The ‘Oral health in all policies’ (OHIAP) agenda looks to aid this transition by working across public sectors to take account of the implications of public policies for health systems and the determinants of health, advocating for multisectoral responses to health challenges.<sup>6, 73</sup> There are profound inequalities in both oral health and oral health services. This is illustrated in a recent report outlining inequalities in England by socioeconomic position, geographic area, protected characteristics and vulnerable (disadvantaged) groups.<sup>74</sup>

## Minamata Convention

The Minamata Convention aims to reduce mercury demand, and as such calls for a phase-down in dental amalgam (the mercury-containing compound which has been used in

‘silver’ fillings over the last 150 years).<sup>75</sup> Led by the United Nations Environmental Programme (UNEP), the approval of the text of the Minamata convention by almost 140 countries in January 2013 was a result of three years of negotiations. The treaty was officially adopted and opened for signatures in October of that year, with 128 current signatures and 127 ratifications to date of this publication.<sup>76</sup>

Measures and commitments from multiple dental stakeholders towards achieving the now ratified Treaty requirements include the setting of national objectives aimed at dental caries prevention and oral health promotion and encouraging insurance policies and programmes that favour the use of high-quality alternatives for dental restoration to allow the phase-down of amalgam.<sup>77</sup> Many current alternatives are plastic-based and there are millions of dollars being invested into the development of effective, environmentally friendly alternatives to traditional materials. The need to make the process of dental restoration more environmentally friendly is clear, however a significantly more important outcome for health will be seen through focusing on an increase in the resource allocated towards effective primary and secondary prevention measures. This shift would reduce the occurrence of caries and cavities, and lead to a reduction in the use of amalgam due to lack of requirement, creating a natural phase-down in both the use of mercury and the incidence of cavities. As fillings typically need to be replaced multiple times and become more extensive with each replacement, preventing the first filling and the start of the unnecessary restorative spiral (Fig. 2) leads to a cascading benefit from environmental, health and economic perspectives.

## Patient and person centricity

Patient and person-centric care in both dentistry and wider healthcare has become more important within policy discussions in recent years.<sup>6</sup> The need for individually tailored responses and care plans is something that is at the heart of preventive oral care,<sup>78, 79</sup> with recommendations tailored to the patient using a simple, yet comprehensive approach such as

the CariesCare International 4D system (Fig. 5)<sup>66</sup> and The International Caries Classification and Management System™ (ICCMS™).<sup>65</sup> The CariesCare International 4D caries management cycle proposes a structured process, providing intervention guidelines to ensure appropriate care and consideration for each patient's needs, identifying early-stage lesions and ensuring appropriate management interventions are in place to avoid the development of cavities.

A patient-centric approach also includes the need to examine global evidence while being mindful of the context and culture of each country and region in implementing actions. Adopting a 'glocal' approach is a concept that has been used by the ACFF for a decade. The model for the use of global evidence adapted to the needs of local implementation. This requires individual country assessments which consider the key characteristics that determine how a preventive model might work within that context. Gross Domestic Product (GDP) per capita, total public spending on health and spending on dental health, 'out of pocket' spending on dental care, access to care and services offered, patient compliance and education, and country-wide patterns of nutrition should all be taken into consideration in developing this approach.

### COVID-19 and the impact on dentistry

COVID-19 can be seen as an opportunity to move the policy agenda forward because of the unexpected and heavy added burden it has placed on society from a health, economic and social standpoint. The pandemic has generated enormous financial challenges for healthcare systems and economies worldwide and has given rise to major disruptions to essential health services. Among them, oral health services were the most affected with 77% of countries reporting partial or complete disruption to service.<sup>4, 80</sup> Learnings from the struggles overcome during the pandemic may now initiate advances towards reforms that can help to solve existing flaws in global and national healthcare systems, such as the lack of prioritisation given to 'non-emergency' oral health care.

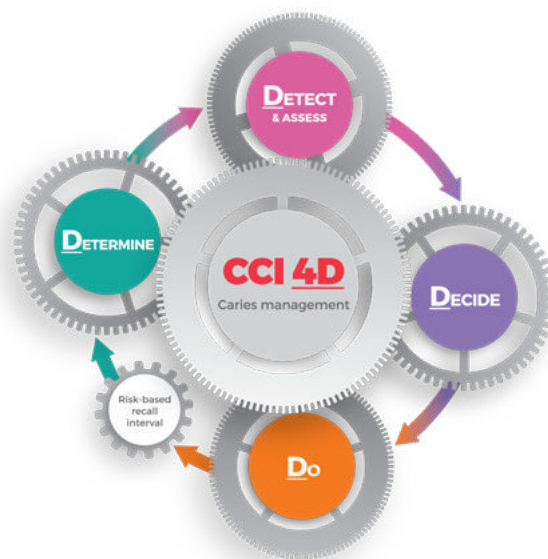


Figure 5 – The CariesCare International 4D Caries Management Cycle

## 4.4 – The value of a cavity-free future

The potential value of a cavity-free future is multifaceted and encompasses economic, social and political benefits as well as direct improvements in health and healthcare systems.

### 4.4.1 – Potential economic impact of a shift to preventive care

Experts have estimated that caries accounts for approximately \$245 billion in global costs. To decrease the burden, countries must increase investments in cost-effective upstream interventions, with a view of reallocating resource from treatment costs to preventive measures, thereby avoiding the costs associated with the restorative spiral and decreasing burden by improving patient health as well as cost savings.<sup>37</sup> This makes caries prevention and management systems, such as ICCMS™ and CariesCare International 4D valuable practice tools which, for minimal cost, can work to decrease overall costs and improve health.

Cost-effectiveness data has been collected showing cost-savings attached to the prevention of certain types of restorative treatment.<sup>81, 82</sup> Also, public health interventions, such as community-based fluoridation

programmes have been shown to be cost-effective caries prevention interventions (when compared with no interventions) as part of studies in Chile and New York.<sup>83,84</sup> The Chilean study also assessed the cost-benefit of school-based fluoride mouth rinse, and also dental sealant programmes for high-risk children, and found them both to have a financial benefit. The New York study found that savings were also achieved through motivational interviewing (which was particularly effective when undertaken with caregivers of children under 2 years old) and fluoride toothpaste brushing programmes.

The Scottish Childsmile programme is recognised in Europe as an example of best practice from a government-supported programme that has provided evidence for cost savings through the implementation of preventive interventions. The programme saw positive outcomes from prevention through a multifaceted program undertaking cost-saving analysis, comparing programme costs against the reduction in decay and the reduction in treatment costs.<sup>85</sup>

The introduction of a 'sugar tax' has, in some economies, shown not only financial benefits but also improvements in both oral and general health. Modelling from the Netherlands has shown that not only would the revenues acquired far outweigh the administrative costs of taxation systems, but it is also possible that a 20% taxation would, without any additional intervention, result in an average of an additional 2.13 caries-free (permanent) tooth years per person.<sup>86</sup> It is likely that this would be comparable to other western-European countries, however of course this figure does not translate directly across the globe.

Despite the indicators above, to offer a full economic overview of how a shift towards preventive care can be economically beneficial we need systematic economic and comprehensive clinical data that has not yet been collected. In other words, we do not yet know the full economic value of a cavity-free future. Acquiring this data is something that the ACFF aims to undertake in the future, in conjunction with international partners.

Finance is not the only indicator of value. Aside from the economic benefit, a key driver in shifting

towards preventively oriented care for dental patients should be the significant benefits that will be seen for not only the individual but also at community and wider societal levels.

#### **4.4.2 – The societal impact of prevention at the individual level**

Dental caries and cavities are responsible for significant negative impacts on an individual's quality of life and can result in profound pain, impact on the ability to eat or desire to smile, and affect social interaction due to embarrassment or shame.<sup>8</sup> The individual benefits that would be seen in a preventively oriented, cavity-free future would be evident in the improved oral, mental, and by commonality, general health of populations. A focus on greater access to preventive care within communities may help those for whom access to care has been problematic feel less marginalised, and result in a general improvement in health and wellbeing. In some systems, a shift towards preventively oriented care may also lead to an increase in uptake of care as people are less fearful of going to the dentist due to a phobia of invasive treatment.

In addition to the direct benefit, it can be demonstrated that early intervention and initial-stage caries prevention can lead to the mitigation of factors that lead to other health conditions, therefore leading to additional long-term health benefits for individuals and populations.

#### **4.4.3 – Prevention for sustainable healthcare systems**

Facing a rise in life expectancy, expensive, complex treatments and limited funding, governments and policymakers need to constantly consider the most effective ways to effectively allocate resources within health systems. The shift towards promoting a preventive outlook in dentistry aligns with current thinking regarding enhancing preventive measures across all areas of health to see a shift towards health maintenance, which is seen as one of the essential strategies to ensuring the future sustainability of health systems.<sup>47,87</sup> This therefore offers policy makers a potential long-term political win, through delivering better service for patients, improving health outcomes and securing value for money.<sup>58</sup>

# 5 – Policy recommendations to make cavities history

**We have demonstrated the need to move towards a more progressive and holistic long-term, patient-centred, tooth-preserving preventive care system, to reduce the incidence of dental cavities and to secure improvements in both oral and general health.**

The task ahead will be to align systems, develop new tools and reimbursement incentives and form a collaborative approach to primary oral care whilst ensuring recognition of the severity of the issue at hand from those with the power to promote change. Making progress with caries requires both global-level policy agreements and country-level policy implementation. With this in mind, the ACFF Taskforce was formed in 2020 to bring together world-leading experts in cariology, behaviour change, public health, and health policy, to create a consensus as to the required direction of travel in order to ensure international level agreement and buy-in as well as locally suitable frameworks for initiating effective policy and systems development. The following are the consensus policy recommendations agreed by the Task Force following an intensive series of virtual meetings held between October and December 2020. These recommendations are offered by the Taskforce to policymakers as a springboard for ensuring that caries and cavities are given a platform within health policy discussion, with a view to successfully influencing improvements in oral and general health.

## 5.1 – Population and health professional education and behaviour must drive change around primary prevention of NCDs

The recognition of caries as a manageable NCD by policymakers, professionals and the public, and the implementation of suitable oral health education programmes for all stakeholder groups will be essential in driving a shift in attitude towards, and improvements in dental caries.

### I – Effective prevention and management of dental caries and cavities across the life course

Oral diseases, notably dental caries and cavities, are largely preventable. Disease prevention and management allow individuals to live a pain-free and high-quality life throughout their lives, and reduces the impact on healthcare expenditure.

#### WE CALL UPON POLICYMAKERS:

- **To recognise caries and cavities** in their national non-communicable diseases (NCDs) plans at the same level as other major NCDs, such as diabetes, which share common risk factors.
- **To implement oral health education programmes** in preschools and schools for both students and parents, with the support of key stakeholders from across the healthcare spectrum, based on best practice examples from across the world, such as the Childsmile programme.
- **To implement oral health education programmes** specifically addressed at vulnerable groups, such as pregnant women, the elderly population, etc.
- **To include oral health curricula prevention and management modules** as part of the formal and lifelong training of healthcare professionals, across the spectrum.

## 5.2 - It is critical to tackle sugar and other major risk factors for NCDs

The availability of, and education surrounding appropriate nutrition and hygiene is a key element in the fight against dental caries. The dangers of frequent sugar consumption, particularly for children under 2 years old, must be addressed through multiple care routes to ensure coverage is broad. By suitably addressing these risk factors, benefits will be achieved across multiple areas of health with an increased awareness of factors fundamental to achieving health across the life course.

### II - Addressing caries and cavities risk factors across the life course to fight major non-communicable diseases

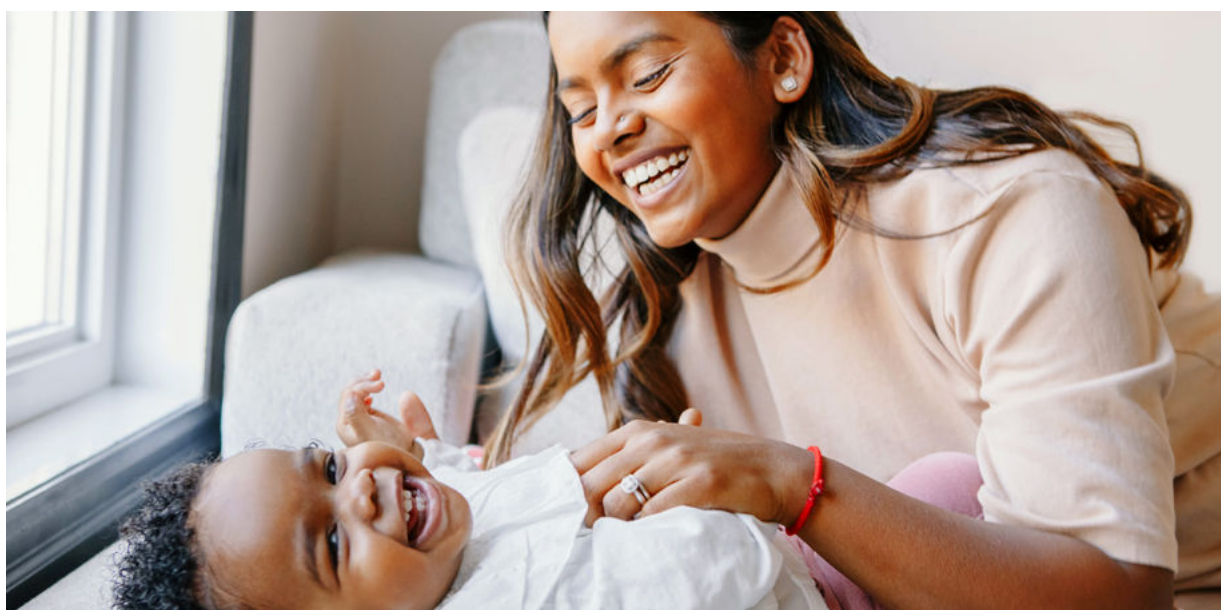
Sugar consumption is one of the most common dietary risk factors across the life course towards developing an NCD, notably diabetes, cardiovascular diseases, cancer, and obesity, and results in massive public expenditures for the treatment of caries and cavities. Reduction in the intake of sugar-sweetened beverages and foods is advised globally as part of healthier dietary patterns to help reduce energy intake, the risk of obesity, and obesity-related disorders.

#### WE CALL UPON COUNTRIES

- **to include oral diseases**, and in particular caries and cavities, into their national NCDs plans when targeting high sugar consumption in major NCDs. In turn, directly addressing caries and cavities will also address the major NCDs.

#### WE ENCOURAGE POLICYMAKERS TO FOCUS ON:

- **Creating effective solutions**, with all stakeholders, to provide affordable and accessible healthy food and drinkable water as well as decrease the purchase of sugared food or drinks through taxation policies.
- **The importance of decreasing sugar intake** in the first two years of life as these years are crucial in determining a child's wellbeing in adulthood.
- **The implementation of oral hygiene education programmes** in primary and secondary school, including nutrition programmes modelling healthy and affordable nutrition and hygiene practices.
- **The promotion of healthy food consumption** across the life course, notably in schools and in the workplace.



## 5.3 - There needs to be integrated primary and secondary caries prevention across the life course

The integration of caries and cavities into wider oral health policies and continuing the push towards including prevention within national health programmes as an essential part of UHC is key to making cavities history. We call for greater access to integrated primary and secondary preventive dental care to maintain health. As part of policy development, consideration must be given to ensuring effective systems are in place to support preventive dentistry and the development of the local workforce delivering care. Achieving effective caries prevention and management across the lifeforce will involve educating and empowering the existing dental workforce to deliver up-to-date care pathways, as well as restructuring health systems to allow for effective continued development in best practice for caregivers. It also means expanding, where possible, the range of people who can advise and refer patients, and, in some cases, treat basic dental health needs to increase care accessibility.

### III - Integration of primary and secondary prevention across the life course to address the burden of cavities and caries

There is no general health without oral health. Therefore, a focus on prevention across the life course is key.

#### WE CALL UPON POLICYMAKERS:

- **To ensure a shift towards optimal standards of care** and preventive dental medicine, which is outcomes oriented and based on best practice implementation, and includes access to affordable future innovations in caries prevention technologies and care delivery, in discussion with all key stakeholders from across the healthcare spectrum. This should furthermore address the reduction of the environmental footprint through the reduction of the use of dental amalgam, in line with the implementation of the Minamata Convention on Mercury, and other restorative materials.
- **To ensure the implementation, access, and affordability** of proven preventive measures, such as public health use of fluoride and effective and affordable fluoride toothpaste, to promote and preserve oral health, in discussion with all key stakeholders from across the healthcare spectrum.
- **To strengthen the interconnectivity** between oral and general health through a holistic approach which integrates oral health into general health promotion strategies as well as in academic curricula and lifelong learning for professionals.
- **To integrate equitable and affordable access to essential care** for the most common dental needs in primary care services (under Universal Health Coverage) to improve the prevention and management of NCDs as well as caries and cavities.
- **To integrate oral health policies**, and in particular the inclusion of caries and cavities prevention policies, into national health programmes as cost-effective measures and part of primary care services, as well as to translate them into national prevention programmes. The focus should be on the entire life course and range from early childhood caries to healthy ageing, in line with the WHO Decade of Healthy Ageing.

## 5.4 - We need systemic surveillance data to monitor actions and progress

So that we can effectively map caries incidence and monitor the success of different approaches to eliminating cavities, multi-national surveillance programmes for data on the prevalence and incidence of caries and cavities are essential. Building an aligned system for reporting from countries of high, low, and emerging economic status will help to offer a more comprehensive overview of the true burden of caries globally, and in turn will help us to monitor successful interventions over the medium and long term in our battle against cavities. This will then allow for effective evaluation and adjustment of programmes and policies, informing future decisions based on examples of best practice emerging from the programmes. A clear, universal reporting language must be used in the creation of these programmes to ensure that the data exchanged is useful and comprehensible and to minimise the margin for error within reporting.

### POLICY RECOMMENDATIONS

#### IV - Comprehensive data collection for effective prevention and management of dental caries and cavities

The lack of data, in general, as well as the lack of consistent data on dental caries and cavities does not allow for proper decision making to ensure effective strategies in the prevention and management of dental caries and cavities.

#### WE CALL UPON POLICYMAKERS:

- **To create a sustainable public surveillance programme** for the collection of data on the prevalence and

incidence of caries and cavities across the life course, taking best practice examples as a starting point.

- **To monitor progress and evaluate the impact of policies aimed** at preventing and managing caries and cavities.
- **To use the same case definition and exchange data** on current oral health policies.
- **To establish a monitoring system** to ensure implementation of the above recommendations.

Steps should also be taken both at an international level and within countries to start to collect appropriate data (with prevalence/disease data which includes initial-stage disease) that will be needed for the long-term assessment of the costs and impacts of caries management and cavity prevention.<sup>88</sup> The potential of expanding existing NCDs frameworks to include surveillance and monitoring of caries risk factors, as well as caries prevalence and burden, should be explored as an efficient route to achieving results across the NCDs agenda. The collection of these data will be a big step in accelerating and refining progress towards a cavity-free future.

# 6 – First actions to secure a cavity-free future

**Keeping in mind the huge, unnecessary burden caused by untreated caries, along with current trends in health policy development, it is clear that now is the time to act against caries.**

The ACFF Cavity-Free Puzzle has been developed over the last few years with a range of stakeholders, as a way of demonstrating the eight key elements that all need to be brought together if we are to be able to achieve and maintain a Cavity-Free Future. The main puzzle identifies (at the global level) the essential and complementary facets of caries prevention and management which all need to be addressed.

These are upstream policy considerations, as well as the scientific and public health driven aspects, complemented by action from dental and other health professionals working with patients, the public and other stakeholders. The lower three puzzles signify local adaptations, where the sizes of individual puzzle pieces are varied to meet the local situation in terms of needs, culture, priorities and economy.

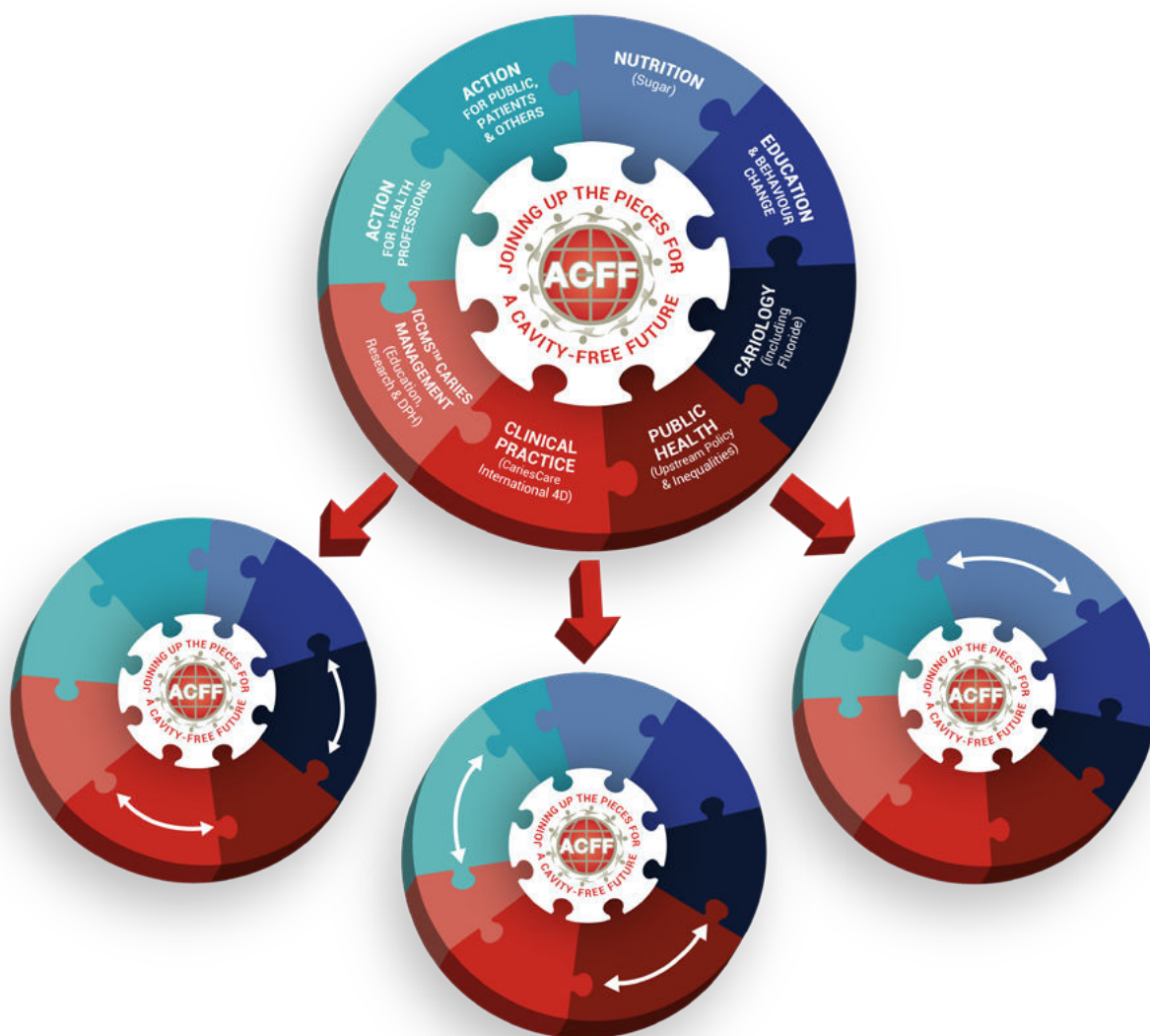


Figure 6: The ACFF Cavity-Free Puzzle; the pieces needed and three “glocal” adaptations

## 6.1 – Adopting and 'glocally' implementing the recommendations

**Adoption of the recommendations at an international level is essential to enabling dissemination through to local systems. We call upon the WHO and other supranational institutions to acknowledge the importance of caries and cavities within the wider oral and general health landscapes and to support the implementation of these recommendations alongside their oral health strategy.<sup>4, 5</sup>**

The recommendations outlined in the previous section are based on global evidence and consensus. These should each be carefully considered by policymakers, with plans made for locally appropriate implementation. This 'glocal' approach must be reviewed within existing systems and delivered through multi-stakeholder collaborations appropriate to local need.

Dentistry alone will not move this agenda forward. Ensuring that stakeholders from across healthcare are aligned to the need for action and are also supported from within systems to work towards change, will enable more effective delivery of the recommendations. The levels of focus will shift depending upon the makeup of the local health systems and local need, as will the priorities for action from within the recommendations.

There are, however, some areas that should be urgently addressed by all stakeholders as key initial actions.

### 6.2 – Examples of early actions required:

- **Early childhood prevention, addressing both caries and other NCDs, should be a key initial priority.** (Recommendations 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 3.2, 3.3, 3.5, 4.2)
- **Resources must be allocated for caries prevention and management, including appropriate care pathways and payment systems that incentivise prevention.** (Recommendation 3.1)
- **Caries prevention needs to be included in UHCs.** (Recommendation 3.4)

To achieve delivery of the policy recommendations, we also need to work collaboratively to promote broader awareness-raising, which will aid in building consensus across the public and multiple stakeholders that cavities are preventable.

It is essential that the uptake and implementation of these recommendations is monitored, and where necessary, additional support or intervention is given to aid in the effective global dissemination of the programme. The ACFF will utilise its network of 28 Chapters covering over 50 countries to co-ordinate with international stakeholders to aid in the design and application of a robust, simple surveillance system to help to achieve this. Adaptation of the NCD Monitoring Framework should be considered in parallel at the country level.

We stand at the door of a rare opportunity. The current landscape is ripe for change, and the consensus from within the dental community is clear. We must act now to ensure optimal health, reduce the unnecessary burden, and create a new type of health system which focuses holistically on health maintaining preventive action to improve health across the life course.

'Locally optimal and culturally sensitive oral healthcare services, delivered through adequately resourced and well-governed health systems, hold the potential to address the multifarious oral health challenges, especially if supported by pro-oral-health policies in other sectors.'<sup>6</sup> Addressing caries and cavities risk factors across the life course to fight major non-communicable diseases will help to strengthen health system capacities and show multi-faceted benefits, and caries must be addressed now as a key building block in the design and implementation of these new systems.

**In order to trigger this change, we need to see a commitment from policy and decision-makers to determinedly move forwards with tackling the issue and bring about health improvements for their wider populations. The burden of caries and cavities is both unnecessary and unacceptable, and we must look to break down the barriers in place to ensure that the message is clear and unified - we can, and we must make cavities history.**

# Executive summary

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## **1 – Globally, dental caries and cavities are responsible for the biggest burden of disease**

### **1.1 – Quality of life is adversely affected by caries and cavities**

Tooth decay affects people in a variety of profound ways. It can cause recurring pain (both acute and chronic), lead to infection and the need for complex, on-going, and expensive rehabilitation. For an individual, suffering from tooth decay can severely compromise the ability to speak, smile, smell, taste, eat and convey emotions through facial expressions, with confidence and without pain.

### **1.2 – Caries creates sizeable economic challenges**

It is estimated that in 2015 dental caries accounted for 245 billion USD globally (161 billion USD in direct costs and 84 billion USD in indirect costs).

### **1.3 – Caries is the most common NCD and has the largest impact within oral health**

A GBD Study puts untreated Cavities at No.1 for Adults and No.6 for Children of all diseases. 2.3 billion people have untreated cavities in permanent teeth, and over 530 million children suffer from untreated cavities of the primary teeth. This is more than for other aspects of oral health.

## **2 – The burden and pain caused by caries and cavities is preventable**

### **2.1 – By tackling caries, we can avoid cavities**

By using established methods of primary and secondary caries prevention (to stop the formation of new lesions and arrest early-stage disease) it is possible to stop cavities.

## **2.2 – Preventing cavities will also tackle NCDs and improve general health**

As caries shares modifiable common risk factors (such as sugar and hygiene) with other NCDs, reducing risk factors can help improve caries as well as obesity, diabetes, and cardiovascular disease.

## **3 – Despite the evidence, caries is typically ignored in health policy**

### **3.1 – Previous global policy recommendations often have not mentioned dental caries**

When only generic references are made to oral health challenges it is hard to get concerted action to address the continuing silent epidemic of caries.

### **3.2 – Dental caries not visible in global or national NCD strategies**

Although dental caries has been formally classified as a Non-Communicable Disease (NCD), it is not recognised or included in National NCD strategies.

### **3.3 – This means it is invisible and does not come with available resources**

When health policy priorities are being assessed caries is often invisible as an issue (or seen as an inevitability) and the resources needed are not available or allocated.

## **4 – A cavity-free future is possible and desirable**

### **4.1 – Various stakeholders have had a shared vision for this for the last decade**

There has been growing acceptance in the dental community that it is possible to control caries with a range of evidence-based interventions.

Traditionally there has been a separation between public health level “preventive” actions and what dentists and other health professionals do for patients – there is now support for aligning prevention and clinical management and integrating dental, medical, and nursing staff to tackle the issue.

#### **4.2 – Dental authorities around the world are united around this vision**

The Alliance for a Cavity-Free Future has been advocating joining-up caries prevention and minimally interventive clinical management for more than 10 years and the vision of delivering preventive dental medicine in caries care is shared by the FDI World Dental Federation and the dental research community.

#### **5 – Making progress with caries requires both global-level policy agreement and country-level policy implementation**

The ACFF Making Cavities History Taskforce has brought together world-leading experts to create consensus over a set of recommendations for policy makers to ensure that caries and cavities are built into health policy discussions. The following are key areas that must be addressed.

#### **5.1 – Population and health professional education and behaviour must drive change around primary prevention of NCDs**

#### **5.2 – It is critical to tackle sugar and the other major food risk factors for NCDs**

#### **5.3 – There needs to be integrated primary and secondary caries prevention across the life course**

#### **5.4 – We need systematic surveillance data to monitor actions and progress**

#### **6 – First actions to secure a cavity-free future**

The first actions include securing appropriate caries recommendations in supranational health strategy by international institutions and, in parallel, ensuring appropriate country-level implementation.

#### **6.1 – Adopting and ‘glocally’ implementing the recommendations (global and then country)**

With global institutions aligned, local governments and policymakers will need to adapt the recommendations suitably for local implementation to ensure that maximum benefit is achieved. There are some areas that should be urgently addressed by all stakeholders.

#### **6.2 – Examples of early actions include:**

- a. Early childhood prevention, addressing both caries and other NCDs, should be a key initial priority.
- b. Resources must be allocated for modern, comprehensive caries prevention and management, including appropriate care pathways and payment systems that incentivise prevention.
- c. Prevention of caries and cavities needs to be included in UHCs.

**The authors of this paper strongly believe that if a concerted, global effort is made, dental caries can be stopped in its tracks and that we might feasibly create a future free from dental cavities.**

# Glossary

For this document, we have used the following consensus definitions relating to dental caries.

**Dental Caries (scientific definition)** 'is a biofilm-mediated, diet modulated, multifactorial, non-communicable, dynamic disease resulting in a net mineral loss of dental hard tissues. It is determined by biological, behavioural, psychosocial, and environmental factors. As a consequence of this process, a caries lesion develops.'<sup>1</sup>

**Dental Caries (lay definition)** is the disease process that causes tooth decay. Caries is assessed on a scale, with different stages of dental lesions with increasing severity. If left untreated, early-stage lesions can progress and become cavities.

**Dental Cavity** is a tooth with caries that has progressed far enough to produce a collapse in the integrity of the outer enamel, exposing the inner dentine.<sup>2</sup>

**Cavity-Free** implies that there are no detected cavities in dentine. However, thorough clinical examination may reveal the presence of non-cavitated and/or micro-cavitated carious lesions.<sup>1</sup>

**Caries prevention** refers to the inhibition of the initiation of caries lesions. Effective primary prevention interventions allow for this to be successful. However, once the caries process has initiated, movement to an appropriate caries care/management programme is desirable to ensure that the lesions do not progress and that the caries is 'arrested'.

**Caries care and management** programmes undertake cavity prevention processes, offering non-operative treatment for lesions that have not progressed to cavity stages. For later-stage caries, tooth preserving operative treatment may be required to prevent further spread of the disease. The treatment and management of caries is risk-based and personalised, it is not a one-time intervention, and caries care and management are something that needs to be continued throughout the life course.

**Early childhood caries (ECC)** is the presence of one or more decayed (either with cavitated or non-cavitated lesions), missing (due to removal stemming from caries), or filled primary teeth (dmft) in a child under the age of 6.<sup>89</sup>

**Non-Communicable Diseases (NCDs)** also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression.<sup>90</sup>

## Prevention

- **Primary Prevention** is the prevention of disease in the absence of disease carried out to variable extents by separate public health groups (such as community-based fluoride strategies as a foundation for oral health)- but often not aligned to others involved with caries care where primary caries prevention is not remunerated or incentivised.<sup>2</sup>
- **Secondary prevention** refers to prompt detection of early-stage disease in order to provide effective arrest and/or regression prior to the cavity stage. This is often not remunerated or incentivised and so is often not practised appropriately (either no assessment or preventive interventions delivered, or premature and inappropriate tertiary stage restorative treatment is delivered instead).<sup>2</sup>
- **Tertiary prevention** is for more advanced (cavitated) stages of lesion severity and aims to prevent further hard tissue

destruction while restoring function and aesthetics and preventing the initiation of new disease. However, restorative care is often provided when not yet needed according to contemporary guidance (tooth structure destroying invasive surgical care provided, but often without any control of the aetiological or risk factors to prevent recurrence of caries). Currently, dentists are mostly paid per restorative treatment administered.<sup>2</sup>

**Sustainable Development Goals (SDGs)** are a series of 17 goals adopted by all United Nations Member States in 2015 which are an urgent call for action by all countries, designed as a "blueprint to achieve a better and more sustainable future for all".<sup>91</sup>

**Universal Health Coverage (UHC)** enables everyone to access the services that address the most significant causes of disease and death and ensures that the quality of those services is good enough to improve the health of the people who receive them. UHC means that all individuals and communities receive the health services they need without suffering financial hardship.<sup>92</sup>

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# Acknowledgements

Our sincere thanks go to the members of the ACFF 'Making Cavities History' Taskforce for their committed involvement and contribution to the development process for both the consensus recommendations and the content of this paper.

The Taskforce was chaired by **Professor Nigel Pitts** (ACFF Global Chair; King's College London; UK) and assisted by the ACFF, led by **Cat Mayne**.

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This project was made possible through an unrestricted grant from **Colgate-Palmolive Company**. The Secretariat to the Task Force was provided by **Burson Cohn & Wolfe**.

# About ACFF

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The Alliance for a Cavity-Free Future (ACFF) is a global not-for-profit organisation that seeks to promote integrated clinical and public health action to confront the burden of tooth decay, fight dental caries initiation and progression, and, along with a global community of supporters, progress towards a Cavity-Free Future for all age groups. The ACFF was established in collaboration with a worldwide panel of experts in dentistry and public health who share a fervent belief in joining together across professional, geographic, and stakeholder lines, to create a unified global movement committed to combating caries in communities around the world.

The activities of the ACFF and its Chapters are supportive and complementary to ongoing WHO Oral Health initiatives and wider initiatives across other oral health matters (e.g., periodontal disease, Noma, oral cancer), whilst remaining focused on caries. ACFF, by nature is an alliance, drawing together and working closely alongside multidisciplinary partners to push for improvements in health, with controlling caries often viewed as a key starting point to seeing more widespread improvement in both oral and general health, with the idea that if we can eradicate cavities the rest will be easier to do.

## **The Alliance for a Cavity-Free Future**

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# MAKING CAVITIES HISTORY

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## The 'Global Burden' of Dental Caries



**2.3 billion** people have untreated cavities in permanent teeth, and over 530 million children suffer from untreated cavities of the primary teeth.<sup>12</sup>



It is estimated that in 2015 dental caries accounted for **\$245 billion** global economic burden (\$161 billion in direct treatment costs and \$84 billion in indirect productivity losses).<sup>93</sup>



While **dental cavities are largely preventable**, untreated cavities in permanent teeth ranked **No. 1** for prevalence in the entire Global Burden of Disease Study - across all of 291 diseases and injuries considered.<sup>12</sup>

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<sup>12</sup> Marcenes, W., et al., Global burden of oral conditions in 1990-2010: a systematic analysis. J Dent Res, 2013. 92(7): p. 592-7.

<sup>93</sup> Vujcic, M., Listl, S. *An economic perspective on the burden of dental caries* (for the ACFF Making Cavities History Taskforce), 2020.

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