

1 **Ending the neglect of global oral health – time for radical action**

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75 ***Abstract***

76 Oral diseases are a major global public health problem affecting over 3.5 billion people.
77 Dentistry however has failed to tackle this problem. A fundamentally different approach is
78 now needed. In this second paper on oral health, we present a critique of dentistry
79 highlighting its key limitations and the urgent need for system reform. In high-income
80 countries (HIC) the current treatment-dominated, increasingly high-tech, interventionist and
81 specialised approach, is failing to tackle the underlying causes of disease and is not
82 addressing oral health inequalities. In low- and middle-income countries (LMIC) the
83 limitations of “westernised” dentistry are most acute – dentistry is often unavailable,
84 unaffordable and inappropriate to the majority of these populations, but particularly the rural
85 poor. Rather than being isolated and separated from the mainstream health care system,
86 dentistry needs to be more integrated with primary care services in particular. The global
87 drive for universal health coverage (UHC) provides an ideal opportunity for this. Dental care
88 systems should focus more on promoting and maintaining oral health and achieving greater
89 oral health equity, rather than the interventionist treatment approach that currently dominates.
90 Sugar, alcohol and tobacco use and their driving social and commercial determinants are the
91 underlying causes of oral diseases, common risks shared with a range of other non-
92 communicable diseases (NCDs). Coherent and comprehensive regulation and legislation is
93 needed to tackle these shared risk factors. In this paper we focus on the need to reduce sugars
94 consumption through the adoption of a range of upstream policies designed to combat the
95 corporate strategies used by the global sugar industry to promote sugar consumption and
96 profits. At present the sugar industry is influencing dental research, oral health policy and
97 professional organisations through its well-developed corporate strategies. There is a pressing
98 need to develop clearer and more transparent conflict of interest policies and procedures to
99 limit and clarify the influence of the sugar industry on research, policy and practice.
100 Combating the commercial determinants of oral diseases and other NCDs is a major policy
101 priority.

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110 **Key messages**

- 111 • Dentistry continues to adopt a treatment-dominated, interventionist, technical and
112 increasingly high-tech and specialised approach to care.
- 113 • Such an approach has failed to tackle the global burden of oral disease; radical reform
114 of dental care systems is now urgently needed.
- 115 • Universal health coverage provides an opportunity for dental services to become
116 better integrated in the wider health care system and to be more accessible and
117 responsive to the oral health needs of the population.
- 118 • Provider payment systems should put more emphasis on incentivising prevention
119 instead of rewarding restorative and interventionist dental care.
- 120 • A different preventive approach, focusing on population-wide impact, is also needed
121 as the current individualistic clinical paradigm has failed to achieve sustained
122 improvements in population oral health or to address persistent inequalities.
- 123 • Integrated public health policies are needed to tackle the shared common risks (free
124 sugars, tobacco and alcohol use and their driving social and commercial determinants)
125 of oral and other non-communicable diseases (NCDs).
- 126 • A range of highly developed corporate strategies are used by the global sugar industry
127 to increase their sales and profits, and to undermine public health efforts to reduce
128 free sugars consumption.
- 129 • There is a pressing need to develop clearer and more transparent conflict of interest
130 policies and procedures to limit and clarify the influence of the sugar industry on
131 dental research and oral health policy.

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Recommendations of this Series

Epidemiology and oral health surveillance systems

Standardised and comparable oral disease surveillance systems are needed to assess the full extent and nature of oral conditions globally. The use of a range of clinical epidemiological disease measures should be complemented with appropriate indicators that assess the wider impact of oral conditions. Established and commonly used oral health indicators should be aligned and integrated with NCD surveillance systems to allow for comparability with and monitoring of global NCD targets and Sustainable Development Goals (SDGs). The World Health Organisation has a key role in leading the development and strengthening of integrated oral health surveillance systems globally.

Reform of oral health care systems

System-wide reform of oral health services is urgently needed. The reformed system needs to integrate with wider health care; incentivise and encourage the prevention and maintenance of oral health; utilise the skills and competencies of wider team of oral health care professionals and other health workers; deliver high-quality, evidence-based treatment; respond to the diverse needs of local populations and promote oral health equity. The growing international momentum towards Universal Health Coverage is a unique opportunity to integrate and reform oral health care.

Education and training of the future oral health workforce

To achieve the goals and aspirations of a reformed oral health care system requires a suitably trained and skilled oral health workforce. Shifting the dentist-centred model of care delivery towards a team approach is essential. Integrated community-based models of training are required to ensure that the future workforce understand and are equipped to respond to population oral health needs and deliver high-quality, appropriate and evidence-based care.

Tackling oral health inequalities

Oral health personnel have a professional and ethical responsibility to provide care in an equitable and fair fashion to meet the diverse needs of their patients and local communities. Oral health care systems need to be more inclusive, accessible and accommodating to

socially deprived and vulnerable groups. Further staff training, resources and closer liaison with support and specialist agencies will be needed to achieve improved oral health equity. Advocacy and wider policy change is also needed to address the broader social determinants of oral health inequalities that lie outside the remit of health systems.

Moving upstream to maximise oral health improvement

Individualistic, clinical and educational preventive approaches may achieve short-term benefits, but these soon fade unless the underlying causes of disease are tackled. Investment in upstream, coherent and integrated population-wide policies should be prioritised such as taxes on sugary drinks, stronger regulation on the advertising and promotion of sugary foods/drinks targeting children, the promotion of appropriate exposure to fluoride through toothpaste and water; as well as embracing a common risk factor approach to address tobacco use and harmful use of alcohol.

Addressing commercial determinants of oral diseases

Stricter regulation and legislation are needed to combat corporate strategies that threaten and undermine oral health and related NCDs. Based upon experience gained from tobacco control, dental professional organisations, academic institutions, individual researchers and policy makers should not accept any funding, sponsorship or support from the sugar industry. Clear and transparent procedures and policies need to be adopted to identify and mitigate any possible objective or perceived conflicts of interests.

Research agenda

Research focusing on oral diseases is often given low priority by research funding agencies. Given the global public health significance of oral diseases, more funding should in future be invested in this important area. Defining a global oral health research agenda would help to direct resources and efforts to addressing critical knowledge gaps including translational and implementation research. Future dental research should focus more on population oral health needs, particularly in LMICs and evaluate oral health improvement interventions that promote oral health equity. Cross-disciplinary research partnerships using a range of appropriate methodologies and study designs are essential.

Global advocacy

The neglect of oral health in the global and national health discourse should be addressed through multi-level advocacy efforts aiming to improve knowledge and awareness of the magnitude of the oral health challenges; create a culture of inclusiveness and recognition vis-à-vis oral conditions and various ways of addressing them in the context of existing policies and programmes (“oral health in all policies”), ensure alignment of efforts to prioritise oral conditions with international policies and frameworks (such as the SDGs, the WHO Global Action Plan on NCDs); and using existing momentum to promote oral health (such as the provisions related to oral health promotion in the UN Minamata Convention on Mercury).

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153 ***Introduction***

154 Despite significant scientific developments in our understanding of the pathogenesis and
155 aetiology of oral diseases over recent decades, the global burden of oral conditions has
156 persisted, and is indeed likely to worsen.¹ As outlined in paper one in this series, oral diseases
157 affect over 3.5 billion people across the world, with untreated dental caries being the most
158 prevalent health condition globally. In high-income countries where overall levels of caries
159 have declined in the child population, the progressive and cumulative nature of the condition
160 into adulthood and older age remains a major problem.^{2,3} Stark socioeconomic inequalities in
161 oral health mean that poorer and more vulnerable groups in society are particularly affected.
162 Oral diseases continue to cause pain, infection and misery for vast numbers of people around
163 the globe and the costs of dental treatment can have a major impact on household budgets⁴
164 and wider health care systems.⁵

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166 In this paper we will present a critique of dentistry highlighting its key limitations and the
167 urgent need for radical reform. The global perspective on dentistry presents three contrasting
168 but interconnected realities. In high-income countries, the current treatment-dominated and
169 increasingly technology-focused system of oral health care is trapped in an interventionist
170 cycle failing to tackle the underlying causes of diseases and not meeting the needs of large
171 proportions of the population. In many middle-income countries the burden of oral diseases is
172 significant, but oral care systems are often underdeveloped and unaffordable to the majority
173 of the population. In low-income countries the current situation is most bleak. Although the
174 overall disease burden is still comparatively low, there are indications that oral diseases are
175 increasing in prevalence.¹ With other competing demands on scarce resources, investment in
176 oral health is very limited, making dentistry an unavailable and unaffordable luxury reserved
177 for the well-off. Most disease therefore remains untreated in the majority of the population,
178 but particularly the rural poor, having very limited access to dental care. To effectively tackle
179 the global burden of oral diseases requires a fundamentally different approach. We argue that
180 a system change is needed - more of the same will achieve little. This is particularly the case
181 in low-income countries where the 'western' model of dentistry is unaffordable,
182 unsustainable and inappropriate.⁶⁻⁸ In addition to reform of dental services, we also highlight
183 the urgent need to change the individualistic, downstream preventive approach that currently
184 dominates, but which has failed to achieve significant population oral health gain or to
185 effectively tackle inequalities. We particularly focus on the need for cohesive, comprehensive
186 and integrated policy action to reduce free sugars consumption, a significant shared risk for

187 dental caries and other non-communicable diseases (NCDs). (Free sugars are defined as
188 monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook
189 or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice
190 concentrates).⁹ We recommend that bold action is needed to address the power and influence
191 of the global sugar industry which uses a wide range of measures to promote their products
192 globally, and to limit the impact of any public health efforts to reduce free sugars
193 consumption. These commercial determinants of oral health highlight the urgent need for
194 stronger regulation and legislation, and also the importance of developing clear and
195 transparent conflict of interest policies to shield industry influence from dental research, oral
196 health policy and professional dental organisations. The paper closes with a plea to step-up
197 global advocacy efforts in the wider health and human development arena in order to end the
198 widespread neglect of oral health globally.

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200 ***Limitations of dentistry – a system no longer fit for purpose***

201 Dentistry is in a state of crisis. Twenty-first century dentistry has largely failed to combat the
202 global challenge of oral diseases.^{1,10,11} This is not the fault of individual dental clinicians
203 committed to caring for their patients. The philosophical approach, system and model of
204 dental care delivery are at fault. (See appendix – panel 1).

205
206 The dental profession and the practice of dentistry are still very much dominated by a
207 treatment, interventionist and technical philosophy that reflects patterns and understanding of
208 dental disease which were current over 80 years ago, and ultimately date back to the surgical
209 origins of the profession.^{7,12} This approach emphasises a biomedical and reductionist
210 understanding of disease causation and a belief that treatment and high-tech intervention will
211 ultimately restore oral health and “dental fitness”. The fundamental principles of dental
212 training have remained broadly unchanged for decades. Although teaching on certain
213 techniques and approaches has evolved, the “dental surgeon” paradigm persists, with dentists
214 largely trained to intervene reactively (i.e. once the disease/problem, has started to manifest
215 itself) and surgically (using a drill, scalpel and/or other instruments) rather than proactively
216 and preventively. Dentist’s training prepares them to be “disease-centred” rather than patient-
217 or “health-centred”.^{12,13}

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219 For a variety of historical, professional, political and economic reasons, dentistry around the
220 globe is largely provided by dentists working independently in the private sector in single-

221 handed or small group practices, often isolated from mainstream health services.^{7,14}
222 Increasingly, in many countries there has been a growth in large corporate bodies and
223 insurance companies that provide health care including dentistry. These commercial, for-
224 profit, organisations can provide high-quality care, but also need to ensure adequate returns
225 on their investments for their shareholders, and therefore have a tendency for promoting
226 excessive diagnostic testing and over-provision of treatment.^{10,15,16} These commercial
227 pressures and incentives fuel an interventionist approach and risk unnecessary, and
228 inappropriate care. Treatment becomes incentivised and drives further treatment rather than
229 health.

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231 There is a significant mismatch between the oral health needs of communities and the
232 availability, location and type of dental services provided. Dentistry is largely a demand-led
233 service, often poorly planned as a result of entrepreneurial choices, and is therefore poorly
234 aligned to the oral health needs of the local population. In HMIC, young children, low-
235 income families, marginalised groups such as homeless people and prisoners, and people
236 living with disabilities are generally underserved¹⁷⁻²¹, whereas dental services often tend to
237 be located in wealthy urban neighbourhoods where affluent “healthy” adults may be
238 receiving unnecessary and often unneeded dental care – a perfect example of the inverse care
239 law.²²⁻²⁴ In many low-income settings the situation is far worse. Across much of Sub-Saharan
240 Africa and many other low-income countries, dental services tend to be located in urban areas
241 inaccessible to the majority of the rural poor. Individuals suffering from dental problems may
242 need to travel far to reach a dentist, or need to resort to using local traditional street “dentists”
243 and be exposed to the risks of using these unregulated providers of care.²⁵ Even though
244 concepts for integrating basic oral health care in primary health care exist, they have failed to
245 gain widespread traction, which further contributes to making access to even basic oral health
246 care a major problem.²⁶⁻²⁸ Coverage for oral health care in LMIC is generally lower than in
247 HIC, with median estimations ranging from 35% in low-, 60% in lower-middle, 75% in
248 upper-middle and 82% in high income countries.²⁹ Within countries, the poorest quintiles
249 have the lowest coverage rates – in Lao, in south-east Asia coverage of the richest quintile is
250 more than 8-times higher than for the poorest.²⁹

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252 The extent to which patients have to pay or co-pay for dental care and the manner in which
253 dental care providers are reimbursed for their services have important bearings for the
254 utilisation and quality of care.⁵ Evidence from high-income settings such as that from the US

255 RAND Health Insurance Experiment has shown that individuals who have to co-pay more,
256 tend to access less dental care.³⁰ Worldwide, there are substantial differences in patient co-
257 payment rates for dental care³¹ and this may limit access to and utilisation of care for people
258 on lower incomes. Households in LMIC face a significantly higher risk of impoverishment or
259 even falling below the poverty line, if they have incurred excessive out-of-pocket payments
260 for dental care.⁴

261

262 The conventional types of provider payment in dentistry include fee-for-service, fixed salary
263 and capitation payments.^{5,32} Empirical evidence for the impacts of the various reimbursement
264 schemes on dental care is relatively scarce.³³ Capitation and salary payments provide good
265 incentives for cost-containment but impose risks of patient selection and/or under-treatment.
266 Fee-for-service payments foster higher utilisation of care but may impede cost-containment.
267 Recently, Chalkley and Listl identified significant increases in the provision of potentially
268 harmful dental radiographs when dentists received fee-for-service rather than salary
269 payments.³⁴

270

271 There is little planning concerning the numbers or distribution of dentists and the wider oral
272 health workforce, nor for the skill sets they require. Even though dentist-population ratios are
273 only a crude measure of oral health care service availability and there is no correlation to
274 disease levels, the numbers of dental personnel show stark variations across countries, as well
275 as within countries.^{35,36}

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277 Some countries have recently seen significant increases in numbers of dental schools e.g. the
278 USA³⁷, Chile^{38,39}, India⁴⁰, Brazil⁴¹ and Colombia⁴², many of which are private, for-profit
279 institutions responding to competition and demand for dental courses, with no reflection on
280 the needs of their local populations.⁴³ (Figure 1). The rapid increases in dentist-to-population
281 ratios particularly seen in certain HMIC are likely to lead to an over-supply of dentists, risk
282 of iatrogenic over-treatment and increasing rates of unemployment amongst dentists.⁴⁴

283 Meanwhile, few of these increasing numbers of dentists move into rural and remote, and low
284 dentist/population-ratio areas, so the vulnerable groups with greatest need for dental
285 treatment remain without care. In many low-income countries few dental schools exist so the
286 supply of dental personnel is very limited. A situation not helped by the “brain drain” of
287 dentists moving to higher income countries where they can earn higher incomes, have better

288 career perspectives, can practice the high-tech dentistry they were taught at dental school and
289 enjoy a better quality of life.³⁵

290

291 Figure 1 here

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293 Problems in dental training and the mismatch between need and provision of care are
294 compounded by the expansion of specialist practices in dentistry.⁴⁴ In the UK for example,
295 there are now 13 different dental specialities.⁴⁵ While there is no doubt that a proportion of
296 patients have complex oral health needs requiring additional specialist skills, most oral health
297 needs can be met by primary care dentists and there is some debate as to whether the
298 expansion in specialist dental practices truly reflects and aligns with the oral health needs in
299 the community.⁴⁶ The growth of specialist practice increases the cost of care and access is
300 often sparse in areas of greatest need. The interface between primary and secondary dental
301 care can be problematic in terms of equity, seamless care, effectiveness and efficiency.

302 ⁴⁷Additionally, eroding the role of primary dental care removes the stable “dental home”⁴⁸ for
303 patients which is essential to ensure they receive appropriate preventive and continuity of
304 care, something of particular relevance to children and adults with high risk of developing
305 oral conditions, such as those living with disabilities and long-term conditions.

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307 Unlike in medicine, in dentistry there is a only limited use of a wider professional team to
308 deliver care.⁴⁴ This is partly a legacy of the “dental surgeon” paradigm, in which the dentist
309 was seen as solely responsible for the diagnosis of disease and the provision of treatment.
310 Many dental schools around the world continue to produce dentists who are trained to treat
311 and work in isolation rather than training a wider range of dental care professionals with
312 different and complementary skills to address the oral care needs of their patients and local
313 populations.^{43,44} Treatment needs range from very simple preventive procedures (such as
314 topical fluoride application), to complex treatments (such as implant retained prosthesis).
315 These can be delivered with greater efficiency, effectiveness and coverage by an oral health
316 workforce with an appropriate and mixed skills set. Mid-level providers are also instrumental
317 in increasing access to dental care in underserved and remote population groups. Indeed, in
318 many settings, and particularly in LMIC, training a more community-oriented oral health
319 workforce rather than dentists is a realistic solution to address the acute workforce shortages
320 and access challenges.⁴⁹ The type of dental professional trained varies across different
321 countries and jurisdictions but commonly consists of dental hygienists, dental therapists,

322 denturists, dental assistants/nurses and dental technicians amongst others. As with many other
323 professional fields, discussions over scopes of practice and the independence of these
324 different professional groups are often complex and fractious. The debate over which of these
325 professionals can do what, under what circumstances, is often decided as a compromise
326 between professional groups rather than with a view to the public's well-being or needs.⁵⁰
327 Despite advances made by the Cochrane Collaboration and other groups, the lack of evidence
328 for many common dental procedures remains a major challenge. This may be illustrated
329 using the example of dental caries. Management of caries has traditionally been to remove
330 decay and place a filling, that regardless of the initial size of the cavity enters the tooth into a
331 cycle of repeat restoration with increasing complexity, eventual failure and tooth loss.^{12,51-55}
332 This "restorative approach" fails to acknowledge that it is not possible to "treat away" caries,
333 neither does it reflect contemporary understanding of the pathogenesis of caries.⁵⁶⁻⁵⁹ Current
334 clinical evidence demonstrates that caries is preventable, and once established, may also be
335 reversible, if detected and addressed in the early stages.⁵⁸⁻⁶⁰ New developments in adhesive
336 dental materials mean that treatment of established disease, that includes appropriate use of
337 topical fluorides,^{61,62} may be managed with less destruction of tooth tissue⁵⁸ and less need for
338 high technological and rehabilitative dentistry.¹² Indeed, since 2017 dental amalgam, the
339 filling material central to this restorative approach is being phased down as part of the United
340 Nations Minamata Convention on Mercury.⁶³ Other long established treatments used in
341 routine dental practice are also being challenged because of the lack of evidence about their
342 effectiveness.⁶⁴⁻⁶⁶ Two pillars of clinical dental practice may serve as examples: the six-
343 month dental recall and scale and polish for the management of gingival and periodontal
344 diseases. The UK National Institute of Health Care Excellence found that there was no
345 scientific basis to the six-month dental recall and recommended that recall intervals should
346 instead be specifically tailored for each patient based on disease levels and disease risk.⁶⁷ A
347 recently completed UK trial demonstrated no clinical benefit in providing either 6 or 12
348 monthly scale and polishes.⁶⁸

349

350 An additional shortcoming is the narrow and somewhat simplistic approach adopted to
351 prevent oral diseases. The use of clinical preventive interventions such as topical fluorides to
352 control caries^{59,60,69} is proven to be highly effective, yet is often seen as a panacea and
353 thereby losing sight of the fact that sugar consumption remains the primary aetiological factor
354 in caries development. While topical fluorides are proven clinical preventive agents,⁶⁹ caries
355 will still develop in the presence of free sugars above 10% of total energy intake.⁷⁰ Even

356 where exposure to fluoride is optimal, evidence suggests that free sugars exposures as low as
357 2-3% of total energy may still carry a risk of caries.⁷¹ The general approach to the prevention
358 of caries has been individualistic and reductionist, focusing on educating patients and the
359 public about individual risk behaviours in oral hygiene and nutrition, with little regard to
360 where and how these behaviours develop and are shaped. This clinical approach to
361 prevention has been unsuccessful at achieving long-term oral health gains or in tackling oral
362 health inequalities.⁷²⁻⁷⁴

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364 In summary, dentistry and oral health care systems need radical reform. The current outdated
365 and treatment-focused approach is failing to meet the oral health needs of large segments of
366 the population, and is totally inappropriate and unaffordable for low-income countries. A
367 different approach is now needed.

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370 ***Rethinking oral health care and improving population outcomes***

371

372 The described limitations of the prevailing dominant approach in dentistry (See appendix –
373 panel 1) indicate their complexity, yet also reveal their inadequacy in reducing the global oral
374 disease burden. From a public health perspective, this lack of global impact would seem to be
375 a good starting point and motivator to consider major, even disruptive innovation in the way
376 dentistry delivers care. In many HIC reform of oral health care systems is often in response to
377 concerns over cost containment rather than more proactive efforts to improve quality of care.
378 Where LMICs are establishing or strengthening oral health care systems, they often strive to
379 follow the example of high-income countries by liberalising health care markets or reducing
380 public health services. Public oral health care is often the first service to suffer as it is
381 considered to be expensive and not essential, resulting in increased unmet oral health care
382 needs.⁷⁵⁻⁷⁷

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384 Key features of an ideal oral health care system have been postulated as follows: no divide
385 between dental and general health care; emphasising health promotion and disease prevention;
386 monitoring and responding to population needs; evidence-based, effective and cost-effective;
387 as well as sustainable, equitable and universal; and empowering for individuals and
388 populations.⁷⁸ The goal would be to achieve better and equitable oral health for all through oral
389 health care being integral to a framework of universal health coverage (UHC), empowering

390 people in self-care, providing protection against health risks, and preventing them from
391 inadequate out-of-pocket expenditures when accessing the required quality oral health care.

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393 Looking at the current practice of dentistry, significant reforms in five key areas would be
394 required to achieve these fundamental characteristics: 1) providing universally available
395 essential oral health care services meeting the most common population needs; 2) innovative
396 oral health workforce models and training; 3) an enabling health system governance context
397 that facilitates a flexible continuum of patient-centered support with appropriate quality of
398 services; 4) integrated surveillance, programme monitoring and implementation research to
399 ensure appropriate health outcomes; and 5) shifting intervention focus to upstream
400 population-wide policies. The implementation of any reforms needs to take into account the
401 local context and population needs.

402

403 Universal oral health care (See Figure 2): The growing international momentum towards
404 UHC is a unique opportunity to integrate oral health care.^{79,80} Bold examples from Brazil
405 (See appendix – panel 2) Thailand have shown that such major reforms are possible and yield
406 positive oral health impacts. Concepts for decision-making are required to select
407 interventions for essential oral health care interventions, which must include prevention and
408 self-care. The WHO-endorsed *Basic Package of Oral Care*, which aimed to direct scarce
409 resources for oral health towards evidence-based interventions addressing essential and
410 common needs, must be reviewed and adapted in the light of implementation experience and
411 recent evidence.²⁶ The concept of *Best Buy* interventions established by WHO to tackle
412 NCDs should be expanded to include cost-effective priority interventions for the prevention
413 and treatment of oral diseases. Appropriate Universal Oral Health Coverage (UOHC) tracer
414 indicators need to be defined to measure all three dimensions of UHC – coverage, financial
415 protection and service quality. Ideally, cost-effective and evidence-based essential services
416 for the most common needs must be available for all segments of the population, with a pro-
417 poor focus and delivered through primary health care; while more costly specialised services
418 would be available at higher referral levels of the health care system. The balance between
419 service availability and inclusion in essential UHC, delivery through the wider dental team,
420 and appropriate financial protection needs to be locally determined.

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422 Figure 2 here

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424 Innovating the oral health workforce: Achieving UOHC requires appropriately-trained oral
425 health care workers with relevant skill mix at all levels of service. This involves shifting the
426 dentist-centered model of care towards a team approach, with non-dentist providers
427 delivering the majority of essential care at the entry level of the primary health care system.
428 More specialised services, provided by dentists and specialists in referral settings, should
429 complement the care spectrum, with advanced care options. Such a model requires a new
430 approach to dental education and training not conceptualised by pre-defined job descriptions
431 or scopes of practice, but rather focusing on community needs and evidence-informed care
432 pathways so that the required care can be flexibly provided in an integrated manner.^{81,82} The
433 focus of training will be on prevention and health promotion, including liaison and
434 collaboration within integrated public health services and community colleagues working on
435 upstream determinants, and referral for complex care.⁸³ Continuing professional
436 development, on-the-job training and appropriate supervision should be mandatory, including
437 training on professional ethics, public health values, social responsibility and avoidance of
438 conflicts of interest.

439

440 Enabling health system context: Integrated, publicly-funded (oral) health care systems require
441 infrastructure, financing, and governance structures that are all tailored to foster collaborative
442 practice and quality services with maximum reach. Professional licensure and regulation
443 must be able to accept overlapping, complementary and flexible scopes of practice to enable
444 needs-based patient care. Payment and remuneration concepts favouring health outcomes,
445 such as Pay-for-Performance systems, have shown some potential to improve quality and
446 outcomes of care.⁸⁴⁻⁸⁶ The share of services delivered by public and private providers can
447 vary and change over time depending on country context, resources and political priorities.
448 The priority for public spending should remain on providing and strengthening public (oral)
449 health care services,⁸⁷ while private sector providers continue to provide specialist care for
450 population segments able to afford the services or with relevant insurance coverage. Quality
451 assurance measures, practice regulations and professional legislation must apply equally to
452 both sectors to prevent differential service quality and the common patient perception that
453 public services are of inferior quality.

454

455 Integrated surveillance, monitoring and implementation research: Evidence, service data and
456 impact evaluations are essential to advocate for, conceptualise, manage, fine-tune and
457 provide services at scale. Appropriate disease surveillance, integrated with NCD and other

458 appropriate surveillance contexts, using relevant existing or new indicators, must be in place.
459 Priorities for oral health research should promote health service and implementation research,
460 including health impact, economic, qualitative, social and mixed research methodologies, so
461 that planners are able to assess programme performance comprehensively, particularly
462 focusing on improving equity. Advocacy for inclusion of relevant oral health information in
463 SDG monitoring and accountability in the context of NCDs should be encouraged.

464

465 Shifting intervention focus on upstream population-wide policies: Oral diseases and
466 inequalities in oral health are caused by a complex array of individual, social, environmental,
467 economic, political and commercial determinants, mostly shared with other NCDs. Although
468 this is increasingly acknowledged across the dental profession globally,^{88,89} the predominant
469 response continues to prioritise downstream interventions. These focus on delivering clinical
470 preventive measures and traditional health education aiming at behaviour change. The
471 evidence, however, shows that such approaches are effective only in the short term^{72,73,90,91}
472 and may increase, rather than decrease socioeconomic inequalities in oral health.⁹²⁻⁹⁴ A
473 bolder and more radical preventive approach is now needed. More of the same will achieve
474 little and is indeed unaffordable in most LMIC. Integrated and coordinated strategic
475 upstream, mid-stream and downstream policies are required that tackle the underlying social
476 and commercial causes of oral diseases. These approaches need to be integrated with the
477 broader NCD prevention agenda and require multi-sectorial working beyond the confines of
478 dental services, and indeed health care systems. Placing (oral) health in all policies requires
479 effective advocacy to achieve broader societal change. Interventions should be tailored to the
480 needs of communities and delivered in a proportionate manner to ensure oral health equity.

481

482 *Sugar reduction strategies*

483 From being a somewhat fringe topic, sugar is now a mainstream global public health priority.
484 Informed by comprehensive and detailed reviews of the international scientific evidence on
485 the role of free sugars on weight gain and dental caries,^{70,95} national and international
486 nutrition guidelines now advocate for population-wide reduction in free sugars
487 consumption.^{9,96,97} WHO recommends for both children and adults reducing free sugars to
488 less than 10% of total energy intake and a further conditional recommendation that sugar
489 should be less than 5% of total energy.⁹ In most countries around the world, free sugars
490 consumption is considerably higher than the WHO recommendation, particularly amongst
491 children and young people, and low-income and disadvantaged groups. A major concern is

492 also the high level of sugars in commercial baby foods (Panel and figure 3). To achieve the
493 WHO guideline will require an ambitious, systematic and coherent sugar reduction
494 strategy.⁹⁷⁻⁹⁹ Upstream policies include international trade agreements on sugar production
495 quotas, price subsidies, minimum price and trade mechanisms. Other upstream policies
496 include industry action in the reformulation of products to reduce their sugar content (similar
497 to what has been achieved in salt reduction), government taxes or levies on sugary products
498 (a 20% price increase is most effective), improved labelling of products to enable consumers
499 to make informed choices, and restriction of the marketing and promotion of sugary foods
500 and drinks, especially to children. Midstream strategies include restrictions on retailers
501 selling high-sugar foods and drinks at checkouts, ending price promotions on sugary products
502 (“buy one, get one free offers”), and a reduction in portion sizes of sugary foods and drinks
503 sold in cinemas and other public spaces. Public sector organisations should not be supporting
504 the sales of sugary products to their users and staff, and finally mandatory food guidelines
505 should be introduced in preschools and schools which should include tighter restrictions on
506 free sugars. Voluntary agreements with industry to reduce sugar consumption have failed.¹⁰⁰⁻
507 ¹⁰² Regulatory and legislative mechanisms are now needed with specific quantifiable targets
508 set and independent monitoring processes established. Upstream sugar reduction policies
509 need to be evaluated using appropriate methods and should include oral health outcomes.

510

511 Panel and Figure 3 here

512

513 Significant progress has been made with the introduction of sugar taxes/levies on sugar
514 sweetened beverages (SSBs) in over 59 countries.¹⁰³ Data from Mexico highlight that pricing
515 policies on SSBs have an effect on reducing sales and consumption, and a reduction in levels
516 of overweight.^{104,105} The positive outcomes resulting from the pricing policies have
517 particularly benefitted low-income groups who generally consume higher quantities of
518 SSBs.¹⁰⁵ The introduction of a national sugar levy can also have a major influence on
519 industry in reformulating their products reducing the sugar content to avoid price increases as
520 seen in the UK. It is important to recognise however that pricing policies alone cannot deal
521 with the sugar related epidemic, a package of coherent policies are needed. The dental
522 profession has an important role to play in supporting the implementation of WHO
523 guidelines to reduce sugar consumption. However undeclared and opaque conflicts of interest
524 between the sugar industry and certain dental organisations and academic institutions need to
525 be addressed (see accompanying Comment).

526

527 **Better political priority for oral health – role of global advocacy**

528 In view of the described significant burden and impacts of oral diseases, the inadequate
529 health system responses and the proposed concepts for reform, a global roadmap or action
530 plan may be a logical next step, with global advocacy as a key strategy to move from
531 concepts to action. So far, oral health advocates and professional organisations have
532 repeatedly highlighted the neglect of global oral health, without offering a realistic vision
533 about how oral health for half of the world’s population can be sustainably improved. On the
534 contrary, the discourse of neglect has been so deeply internalised that often it appears to be
535 the only and central challenge for oral health globally. The priority accorded to oral health is
536 indeed inadequate in many contexts; symptoms and consequences of neglect are manifold.

537

538 The ensuing debate, however, is often rather limited and re-active, focusing on justifying
539 more resources towards expanding current oral health care models, thus doing more of the
540 same. This points to a key weakness hampering effective advocacy – a clear objective to
541 argue for or against something is required. The narrow focus of advocating a higher priority
542 for oral health may have deflected resources and efforts from generating a broad consensus
543 among key sector stakeholders about a joint problem definition, agreement on population-
544 level interventions, and approaches to reform and strengthen oral health systems. The current
545 state of global oral health is hence not only a result of external factors such as competing
546 disease priorities or lack of resources, but also related to inadequate coalescence and
547 leadership among global oral health actors, further widening the disconnect with the wider
548 global health mainstream.¹⁰⁶

549

550 The processes and politics behind changing global health priorities has been studied and key
551 elements for change have been identified.¹⁰⁷ Today, the situation is far from the bold priority
552 that oral health received in 1994, when the WHO declared the first-ever “International Year
553 of Oral Health”, following-up on the declaration of global goals for oral health by the year
554 2000.^{108–110} Since then, the WHO’s Global Oral Health programme was scaled-down from a
555 well-staffed unit to a single position at headquarter level. Such changes were subsequently
556 mirrored by WHO member states who also limited their oral health resources or did not even
557 establish national oral health programmes. The ongoing organisational reform of WHO may
558 be an advocacy opportunity to correct the under-resourced situation of oral health at WHO
559 headquarters and regional levels.

560

561 Oral health is part of the basic human right to health and integral to sustainable human
562 development – key notions of a rights-based approach to global advocacy.³⁵ Promoting oral
563 health positively contributes to overall development by easing the disease, economic and
564 social burden caused by oral conditions. (Figure 4).

565

566 Figure 4 here

567

568 The global health agenda continues to provide many opportunities for advocacy, yet they
569 need to be monitored, filtered and seized upon (See appendix – panels 3-5). More recently,
570 the commercial determinants have seen increasing attention, and the various interlinkages
571 with other determinants of health have been highlighted. Together with other international
572 health frameworks they provide opportunities for impactful advocacy, benefiting not only
573 oral health but also NCDs and sustainable development at large.

574

575

576 **Conclusion**

577 Oral diseases are a major global public health problem. The current public health and health
578 system responses are largely inadequate, inequitable, and costly, leaving billions of people
579 without access to even basic oral health care. Simple, cost-effective and equitable
580 interventions exist, as well as population-wide upstream policy measures to reduce risks that
581 are common to NCDs and oral diseases. Setting public health, oral health professional, health
582 system, education and training, research and policy priorities on a path towards Universal
583 Oral Health Coverage requires sustained and concerted political support and engagement of
584 all stakeholders, including patients and communities. Achieving such convergence of efforts
585 needs bold leadership, solid evidence, innovative policies and openness to a global change
586 agenda on all levels. As the world intensifies efforts to reach the Sustainable Development
587 Goals within the coming decade, oral health can no longer be left behind and requires urgent
588 and decisive action.

589

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592

593 **Contributors**

594 All authors jointly formulated the major concepts of this paper and approved the final
595 version. RW, BD, PA, SL, HB, and CK initially drafted and edited sections of this paper. RW
596 and CCG-H analysed the growth in commercial baby foods in selected countries, and BD,
597 RV, RKC and CCG-H assessed changes in dental schools in selected countries. LMDM,
598 RKC and MP specifically made critical revisions to the text for important scientific content.
599 RGW and HB provided overall supervision. All authors provided information and references
600 for this paper.

601

602 **Declaration of interests**

603 The authors have stated explicitly that there are no conflicts of interest in connection with this
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605 not necessarily represent the views or policies of the institutions with which they are
606 affiliated.

607

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611

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620

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Panel: Commercial baby foods – a sugary start to life

The global commercial baby food market is estimated to be worth over US\$37 billion in 2010 with Europe, US and Asia holding the major share of the market. However emerging economies are expected to see high growth in sales.¹¹¹ Analysis of sales data in selected countries show high growth rates between 2004 and 2017 particularly in China, United Arab Emirates, Russia, Vietnam, Peru, and Indonesia, although sales have also risen steadily in Czech Republic, Colombia, Brazil and South Africa (Figure 2).

Commercial baby foods are generally highly processed products often containing high sugar levels. A very recent European Commission Report of over 4200 commercial baby foods and drinks sold across Europe revealed that 41% of products analysed contained free sugars.¹¹² Free sugars were particularly found in baby biscuits and rusks, baby cereals, baby juices and drinks, baby fruit products, desserts and yogurts and baby snacks. An Australian study has recently reported that nearly a quarter (23%) of 12-14 month old babies had consumed free sugars above the 5% WHO recommended level, and that the major source of sugars came from commercial baby foods (27%), cereal based products (20%) and yogurts (10%).¹¹³ The consumption of sweetened commercial baby foods is a major concern as this presents a significant risk for early childhood caries, encourages infants to develop a preference for sweetness and may contribute to overweight in later childhood.

629

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