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OFFICE OF CHIEF DENTAL OFFICER ENGLAND

Sustainability in dentistry: Leading for change

ENVIRONMENTALLY SUSTAINABLE DENTISTRY TO ADDRESS THE CLIMATE CRISIS

September 2023

Supported by College of General Dentistry

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Foreword

Sara Hurley and Abhi Pal

The challenge and enormous complexity that the issues of climate change bring will continue to affect the populations that we as a dental profession serve and the world in which we live. As one of the most significant challenges to our health, we need to take this challenge seriously. We owe it to current and future generations to make our practice of dentistry as environmentally and socially sustainable as we can.

> "DENTISTRY AS A PROFESSION SHOULD INTEGRATE SUSTAINABLE DEVELOPMENT GOALS INTO DAILY PRACTICE AND SUPPORT A SHIFT TO A GREEN ECONOMY IN THE PURSUIT OF HEALTHY LIVES AND WELL-BEING FOR ALL THROUGH ALL STAGES OF LIFE."
>
> FDI World Dental Federation Policy statement: Sustainability in Dentistry, 2017

Delivering health and social care more sustainably can itself improve health: from infrastructure to clinical practice and more efficient medicines prescribing. By delivering care locally or virtually, we can all contribute to a reduction in our carbon footprint. There may be a transitional cost in shifting to sustainable healthcare provision, but there is immense value in doing so. The right investment in the most appropriate initiatives, and the most effective change to process and procedures will ensure that solutions are both environmentally and economically beneficial in the longer term.

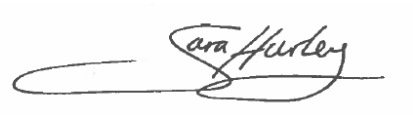
Dental care, whether in a primary care, community or hospital setting creates a significant carbon footprint. The rationale and requirement to embed sustainability into our core considerations for practice are acknowledged. The decisions we make delivering clinical care and services, as well as the actions that we take to improve health outcomes for our patients, both require continuous evaluation. We need to ensure that evidence-based good practices and our broader collaboration actively supports and empowers every member of the dental team to recognise and fulfil their responsibilities.

With many advocates and early adopters passionate to deliver tangible improvements for sustainability in dentistry, there is a body of references to support the transition to a greener practice model. Practices can improve efficiencies in the management of energy through better patient outcomes derived from refining care pathways and prescribing techniques, better use of technology to augment care where appropriate and an enduring focus on prevention.

By supporting dental teams to design and realise their Green Plan for Dental Practice we can ensure that our ambition for sustainable dental care is aligned with the wider national ambition, and critically with the Green Plans of Integrated Care Systems that dental practices will increasingly be an integral part of. Hospital based dental teams should already be contributing to and implementing their Trust's Green Plan. With the advent of the Integrated Care Systems (ICSs), primary care and community care dental teams are encouraged to actively engage with their Primary Care Networks and collaborate with their ICS on local programmes of work.

This document sets out our aspiration for the direction that the profession needs to take to move towards sustainable dentistry: committing to act with the climate crisis in mind, and then sharing our achievements and our failures. All change begins with having an aspiration and we hope further practical guidance will be produced to support our teams.

All staff need to play their part in delivering sustainability and we encourage members of the profession to actively collaborate with each other and with our healthcare colleagues to achieve our aims.



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Executive Summary

As part of the Chief Dental Officer's Clinical Fellowship Scheme 2021/22, clinical fellows working within many different organisations across the dental sector worked together to produce a snapshot report of environmentally sustainable activities in dentistry.

This report aims to provide a scoping review to inform and engage the oral health and dental care profession on the environmental sustainability of practicing dentistry. It has been written to facilitate discussions and relationships between the dental profession, dental industry, and wider oral health and dental care infrastructure to embed sustainable practice by inspiring change at all levels of oral health and care.

The report has been written thematically, making recommendations for change that can be undertaken by each part of the system. It presents case studies of exemplar efforts made to address the environmental impact of dental care and oral health services. This report also signposts the plethora of resources already available at the time of publication that provide the evidence base and further reading for this agenda.

Commitment for change

Everyone has the potential to instigate change, individually or as part of an organisation. To enable the change required for a sustainable future, we must:

- Be aware of the problems we face.
- Understand the evidence base.
- Empower everyone to act.

Key points

- Oral health is an integral part of personal health, and dental care is an essential form of primary healthcare.
- The climate crisis affects health, and in turn, oral health and dental care contribute to the climate crisis, estimated at 675,706 tonnes of carbon dioxide equivalent (tCO2e) greenhouse gas emissions.
- All four UK health services have committed to net zero carbon emissions, and active participation in decarbonising both public and private sector services is necessary for a sustainable system of the future.
- Sustainable healthcare is defined as healthcare that meets the needs of patients and populations of the present without compromising the ability of future generations to meet their own needs.
- Key legislation, policies and guidance are available to support change; these are listed in appendices 1, 2 and 3 respectively.
- Conscientious prevention of disease and delivery of clinical oral health and dental care can contribute positively to sustainability.
- Meaningful and persistent change is required across the oral health and dental care system to address environmental sustainability.
- There are resources available to support individuals and teams across the oral health and dental care system to embed environmental sustainability.
- Sharing progress towards achieving climate targets is actively encouraged.
- By undertaking at least three actions listed for your professional group in Appendix 4, you will be contributing to positive change.

Introduction

The risk of climate catastrophe threatens to undermine the last 50 years of global gains in public health; however, the climate crisis has been called “the greatest global health opportunity of our time” by the 2015 *Lancet* Commission on Health and Climate Change[1]. Helping populations live healthier lives in healthier environments will have significant benefits to the health and wellbeing of our species, and the ecosystem in which we live.

Oral health is an integral part of personal health, and dental care is an essential form of primary healthcare. Active participation in decarbonising oral health and dental care services is necessary for a sustainable system of the future.

The report aims to inform and demonstrate how oral health and dental care infrastructure in the UK can adapt and evolve to meet the difficulties of an increasingly demanding world.

Background

The climate crisis

The Sixth Assessment Report (AR6)[2] produced by the Intergovernmental Panel on Climate Change (IPCC) on the physical science basis of climate change provides a stark warning concerning the state of the earth. The Paris Agreement 2016 was signed by the UK in 2015. Despite the ambition to limit global temperature rise to 1.5ºC, July 2021 was the hottest month ever recorded across the planet[3].

Human influence has warmed the atmosphere, ocean and land at an unprecedented rate over the last 200 years. Human-induced climate change has caused widespread adverse impacts, including more frequent and intense extreme weather events with related losses to nature and people beyond natural climate variability. Any further delay in concerted global action to adapt and mitigate these impacts will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all.

The impact of the climate crisis on human health

The climate crisis is a health crisis. The most recent report by the Lancet Countdown: Tracking Progress on Health and Climate Change reviewing 44 key indicators exposes the unabated rise in the health impacts of climate change[4] unfolding in the context of COVID-19. The pandemic arising from the novel coronavirus SARS-CoV-

[1] Wang, H and Horton, R. 2015. https://doi.org/10.1016/S0140-6736(15)60931-X
[2] https://www.ipcc.ch/report/ar6/wg1/
[3] https://www.noaa.gov/news/its-official-july-2021-was-earths-hottest-month-on-record
[4] https://www.thelancet.com/action/showPdf?pii=S0140-6736%2821%2901787-6

2/COVID-19 has affected health, livelihoods and communities worldwide. This latest challenge to global health has exposed deep fissures and inequities in the world's capacity to cope with, and respond to, health emergencies.

Adverse health effects caused by changing climate include respiratory and allergic disorders, heat-related disorders, vector-borne diseases, foodborne and waterborne diseases, malnutrition, and mental health problems.[5] A survey of 16- to 25-years olds has found that climate change is causing distress, anger and negative emotions in thousands of children and young people worldwide.[6]

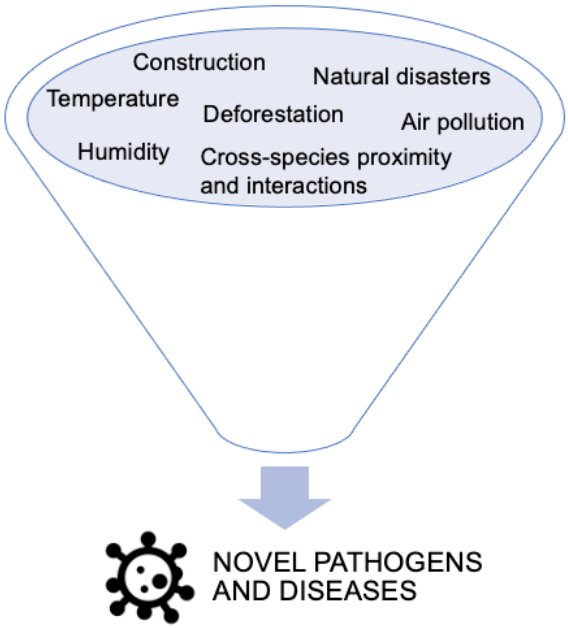

Figure 1: Changing climatic parameters thought to contribute to the COVID-19 pandemic. Source: adapted from *Did Climate Change Influence the Emergence, Transmission, and Expression of the COVID-19 Pandemic?* (2021).

It has been suggested that the emergence, rate of spread and outcomes of COVID-19 could have been affected by changing climatic parameters (Figure 1)[7]. Neither COVID-19 nor climate change respect national borders: the current health consequences of delayed and inconsistent responses of countries around the world provides a clear imperative for accelerated coordinated action to put the health of people and planet at the forefront of operations.

The climate crisis and social justice

Climate change affects all nations around the world, but its effects are not felt equally.

On a local or national level, those people who are most vulnerable to the adverse environmental and health consequences of climate change include: poor people, members of minority groups, women, children, older people, people with chronic diseases and disabilities, those residing in areas with a high prevalence of climate-related diseases, and workers exposed to extreme heat or increased weather variability. The UK is particularly at risk of drought, flooding, and extreme weather events.[8]

Adaptation and mitigation measures to address climate change will also need to be planned to protect human rights, promote social justice, and avoid creating new problems or exacerbating existing problems for vulnerable populations.

[5] https://www.cdc.gov/climateandhealth/effects/default.htm
[6] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3918955
[7] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8694059/
[8] https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2022

The impact of oral health and dental care on the planet

Unfortunately, healthcare is part of the problem: The health sector, responding to the immediate human sequelae of climate change, also makes a significant contribution to the climate crisis: if the global health care sector were a country, it would be the fifth-largest greenhouse gas emitter on the planet[9].

Oral health is a vital component of general health, and dental care is part of health and social care. It is time for the oral health and dental care profession, industry, and system to assess, recognise, understand, and act on its contributions and respond to the climate emergency.

According to Carbon modelling within dentistry, NHS dental services in England 2013-14 contributed 675,706 tonnes of carbon dioxide equivalent (tCO2e) greenhouse gas emissions. This is equivalent to flying 50,000 times from the UK to Hong Kong and makes up 3% of the overall carbon footprint of the NHS in England. Unlike the distribution of emissions presented in Delivering a 'Net Zero' National Health Service, the highest proportion of dental emissions is caused by travel: 64% of the dental footprint can be attributed to patient travel and staff commuting (Figure 2). Emphasis is often placed on waste products due to their tangibility, however procurement, energy and nitrous oxide release are the next most significant contributors to greenhouse gas emissions, followed by waste and water. This understanding is vital for planning mitigation and adaptation efforts.

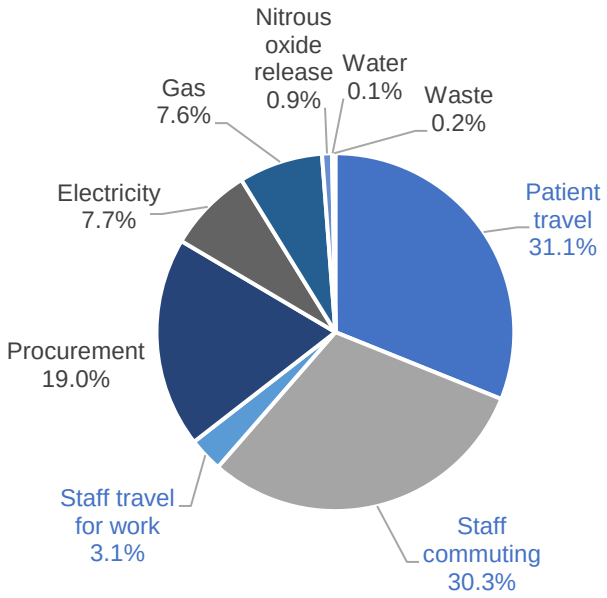

Figure 2: Total annual carbon footprint of dental services in England 2013/14. Source: Carbon modelling within dentistry (2018).

UK health service emissions targets

As of November 2021, all four UK health services have committed to net zero carbon emissions[10] in alignment with the UK's overall commitment to reach net zero carbon emissions by 2050[11]. The commitments were made as part of the UK's COP26 Presidency alongside healthcare systems across the world and in partnership with the

[9] https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf
[10] https://www.gov.uk/government/news/uk-health-services-make-landmark-pledge-to-achieve-net-zero
[11] https://www.gov.uk/government/news/uks-path-to-net-zero-set-out-in-landmark-strategy

World Health Organisation, United Nations Framework Convention on Climate Change, Healthcare Without Harm and others.

It is important that any oral health and dental care practitioner, in both public and private sector, understands the UK's legal commitment to climate targets. Those providing NHS care in the UK should be aware of the net zero ambitions of devolved health services, and individuals, organisations and systems should be working towards meeting the associated targets.

NHS England

NHS England is tracking and reporting its carbon footprint to meet the commitments of the Climate Change Act (2008), and any service, including oral health and dental care, funded by NHS England is required to be working towards the targets set out in Delivering a 'Net Zero' Health Service:

- For the emissions NHS England controls directly (the NHS Carbon Footprint), net zero is reached by 2040, with an ambition to reach a 50% reduction by 2026 and 80% reduction by 2028-2032
- For the emissions NHS England can influence (our NHS Carbon Footprint Plus), net zero is reached by 2045, with an ambition to reach an 80% reduction by 2036-2039

NHS Northern Ireland

The Climate Change Act (Northern Ireland)[12] was enacted in June 2022, which supports the UK target under the Climate Change Act (2008) in relation to NI's contribution to the UK net zero by 2050. Thus far, there is no NHS NI strategy with regard to this agenda.

NHS Scotland

NHS Scotland aims to become a net zero carbon emissions health service by 2045, with the ambition to bring this forward to 2040, described in the latest draft of the NHS Scotland Climate Emergency & Sustainability Strategy.

NHS Wales

In 2019, the Welsh Government declared a Climate Emergency supported by Members of the Senedd and have since set out an ambition for the public sector to be net zero by 2030[13]. The NHS Wales Decarbonisation Strategic Delivery Plan contains 46 commitments for delivery by 2025.

[12] https://www.legislation.gov.uk/nia/2022/31/enacted
[13] https://gov.wales/nhs-wales-contribution-towards-net-zero-public-sector-2030-whc2021024

What is environmentally sustainable oral health and dental care?

Definition

As late as 2017, sustainability of healthcare in the UK was still being referred to only in the context of finance, efficiency, acceptability, resilience and longevity[14].

In this document we refer to sustainable healthcare in terms of environmental sustainability: healthcare with an ecological base, that is environmentally, economically, and socially viable. **The goal of sustainable healthcare is to meet the needs of patients and populations of the present without compromising the ability of future generations to meet their own needs**[15].

Creating more sustainable health systems involves reconsidering and redefining what value means to us[16]. 'Sustainable value' explicitly considers the environmental, social and financial impacts in relation to health outcomes for both patients and populations (Figure 3) – the 'triple bottom line'. We need to think of the triple bottom line where we are equally reliant on social assets (the networks, such as staff, carers and patients themselves) and environmental resources, not just financial costs.

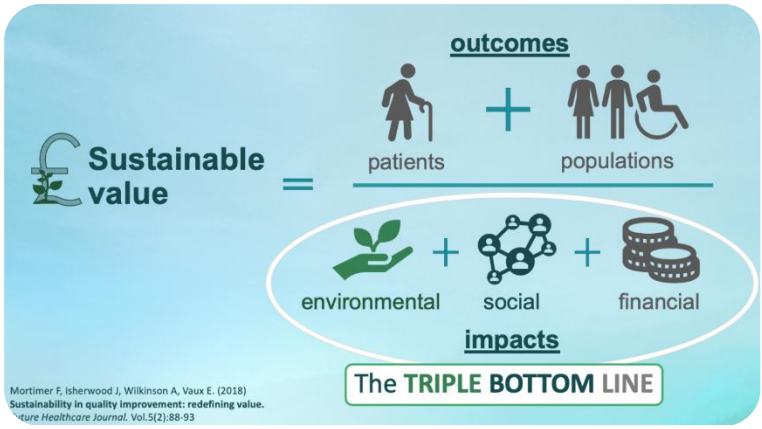

Figure 3: Describing the triple bottom line in the form of an equation considering patient and population outcomes over the environmental, social and financial impacts. Source: adapted from Mortimer et al. (2018).

There is an established movement as part of the wider health and care sector to practice sustainable healthcare. Similar engagement and understanding across the oral health and dental care sector is lacking.

[14] Crisp, N. 2017. https://doi.org/10.1136/bmj.j3895
[15] https://noharm-uscanada.org/content/us-canada/history-and-victories
[16] https://www.rcpjournals.org/content/futurehosp/5/2/88

Principles of sustainable healthcare

The Centre for Sustainable Healthcare developed four principles of sustainable clinical practice, shown in Figure 4.

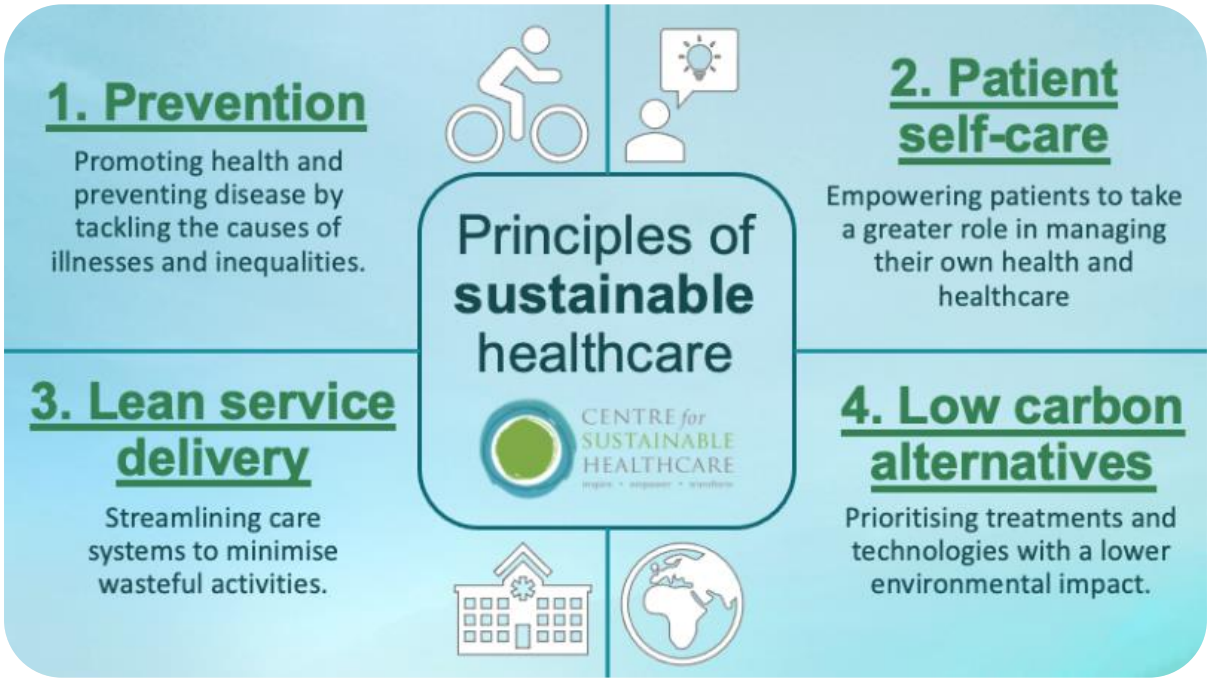

Figure 4: The four principles of sustainable healthcare in descending order of importance. Source: adapted from Mortimer et al. (2018).

These principles can be adapted for dentistry, with examples shows in Figure 5.

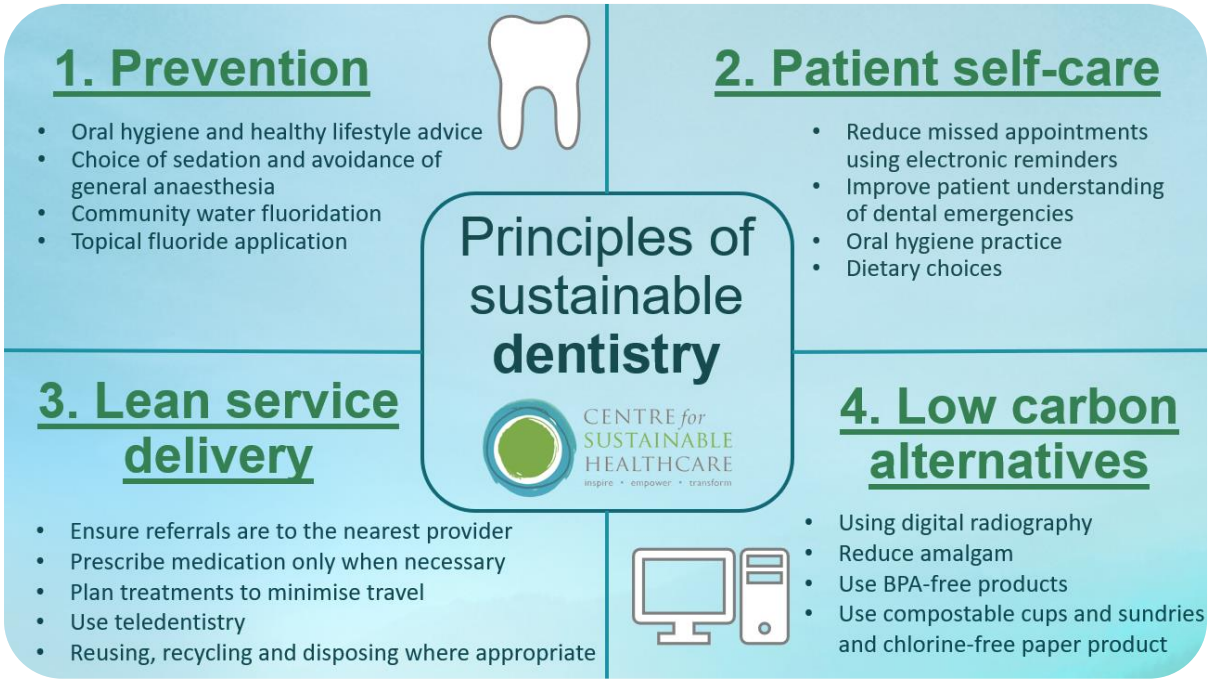

Figure 5: Examples of the four principles of sustainable healthcare when adapted for dentistry. Source: adapted from the Centre for Sustainable Healthcare (2016).

Quality Improvement and Assurance

Quality improvement (QI) aims to make healthcare "safe, effective, patient-centred, timely, efficient and equitable". In doing so, a variety of methods and tools are adopted, which essentially involve identifying the issue, measuring impact, and identifying and testing potential change ideas, which are iterated based on evidence of the impact[17].

While traditional methods of clinical governance rely on clinical audit[18], quality improvement (QI) empowers people closest to a problem with the skills and resources to be able to solve it. Sustainability in quality improvement (SusQI) embeds sustainability into the quality improvement framework, measuring the health outcomes of a service against its environmental, social and economic costs and impacts to determine its "sustainable value", described above in Figure 3. All healthcare practitioners should be able to understand and apply this QI methodology to improve healthcare provision, and this should be encouraged and celebrated as part of professional development.

[17] https://www.health.org.uk/publications/quality-improvement-made-simple
[18] https://www.nature.com/articles/s41407-020-0437-3

What does the oral health and dental care system need to know about environmental sustainability?

Legislation

Legally binding targets to protect our environment were published by the UK Government in December 2022[19], followed by the Environmental Improvement Plan 2023. We are over halfway through the allocated timeframe to achieve UK carbon ambitions of reducing net UK emissions to 100% lower than the 1990 baseline. The scale and pace of carbon reduction ambitions has increased such that a new emissions interim target of 78% by 2035 was announced in April 2021. In June 2021 the UK Climate Change Committee (CCC) published its latest Progress report to Parliament: there has been an increase in the scale of government efforts, but progress is not yet in step with the urgency of the challenge. Key legislation is listed in Appendix 1.

Oral health and clinical dental policy

Health policy defines health goals at the international, national or local level and specifies the decisions, plans and actions to be undertaken to achieve these goals.[20] Policy explicitly referring to environmental impact can clarify the value of protecting health and health systems for now and for the future. Key policies are listed in Appendix 2.

Clinical policy in dentistry, produced by the four UK Chief Dental Officers, comprises sets of principles that may either align with a population based oral health strategic vision or support the delivery of clinical services[21]. Like many areas of healthcare delivery, existing national clinical policies in dentistry for the UK do not currently consider environmental impact[22]. It would be prudent to implement agile policies and strategies that are evaluated based on both individual and population outcomes, as well as using environmental sustainability metrics. Furthermore, commitments and the success of strategies should be subject to accountability, governance and review against planned targets[23].

This is a relatively untapped area of research, and quality peer-reviewed literature on sustainability in clinical dental policy is lacking. There is significant potential for embedding sustainability into clinical dental policy. However, it is suggested that due to primary care dentistry's composition of small, independently owned businesses and

[19] https://www.gov.uk/government/news/new-legally-binding-environment-targets-set-out
[20] https://www.euro.who.int/en/health-topics/health-policy
[21] https://www.england.nhs.uk/primary-care/dentistry/leading-the-change/
[22] https://www.england.nhs.uk/primary-care/dentistry/clinical-policies/
[23] https://www.longwoods.com/content/26376/healthcarepapers/the-uk-national-health-service-is-world-leader-in-sustainable-healthcare-recommendations-for-canada

larger corporate businesses, there lacks internal expertise and incentive to produce sustainability policies.

Clinical policy could have a substantial impact on the sustainability of clinical services, by influencing clinical choice and the health professionals who are making those choices. Environmental sustainability isn't simply about restricting clinical services to the least 'carbon intense', or perhaps more correctly, the least environmental intense option. Sustainability considers the many factors that contribute to the outcomes and impact of services.

Ultimately, clinical decisions lie with clinicians who are treating patients, but the clinical policy framework within which services operate needs to allow, encourage, and support the provision of environmentally conscious services[24].

Guidance

A review of 49 clinical guidelines from British, Chinese, Indian, Brazilian, Australian, European, German, and US-American medical associations found fewer than 5% of guidelines referenced keywords related to planetary health[25] (e.g., climate change, air pollution, and emissions).

Prominent and respected groups of guidance providers, such as the Scottish Dental Clinical Effectiveness Programme (SDCEP), National Institute for Health and Care Excellence (NICE), British Dental Association (BDA), College of General Dentistry (CGDent), Royal Colleges of Surgeons, and others, should all be including the environmental impact of their recommendations and advice as standard, as based on the outcomes of the triple bottom line (Figure 3).

It is encouraging to note that the recently updated Anticoagulants and antiplatelets SDCEP guidance did indeed consider environmental impact during the development update, described in their methodology report, using five key areas identified in the How-to guide for dental practices. However, a robust, reliable framework for the inclusion of environmental impact in clinical guidance needs to be established to promote standardisation across these guidance bodies. Available publications and key guidance are listed in Appendix 3.

[24] Duane, B. et al. 2020. https://doi.org/10.1177%2F0022034520919391
[25] Herrmann, A. et al. 2022. https://doi.org/10.1016/S2542-5196(22)00041-9

How can delivery of clinical oral health and dental care contribute to sustainability?

Clinical and professional leadership

Environmental sustainability means we have considered not only the clinical factors pertinent to caring for the individual patient, but also the impact made by that clinical delivery on current and future populations.

With the publication of Climate and health: applying All Our Health, the Office for Health Improvement and Disparities with the UK government has given permission for healthcare professionals to advocate for action on the climate crisis. Oral health and dental care professionals ought to recognise the climate crisis as a health crisis, and therefore climate action as a core part of their professional responsibilities. Key recommendations for both individuals and dental teams are made in Appendix 4.

It is here that cross-sector clinical leadership is needed. The whole oral health and dental care system needs to drive down climate impact and anthropogenic (human-caused) damage accountable to dentistry as standard operating procedure. Clinicians who follow the Clinical guidelines for environmentally sustainable dentistry show leadership and dedication to improving oral health and dental care services.

It is increasingly clear that incorporating public health into every climate policy decision is more critical than ever. Complementary efforts must be made to equip leaders in independent healthcare practices, limited companies, corporations, organisations, and healthcare systems to include climate policy into health and clinical policy right across the system.

Embedding environmental sustainability within system leadership provided by professional bodies is a valuable opportunity to support this agenda and encourage action, demonstrating its importance to the sector and commitment to progress. There are many dental and oral health organisations who have not been approached by the authors, but it is hoped that this document inspires organisations to share initiatives to accelerate improvement.

Prevention

Many issues and ailments that dental professionals see are preventable, thus good dentistry maintains oral health and prevents disease. A system-level focus on prevention will improve health outcomes and quality of life for individuals, reduce the need for care and could save health services money in the long run[26]. The Delivering Better Oral Health Toolkit provides evidence-based interventions and advice on how

[26] Martin, N. Mulligan, S. 2022. https://doi.org/10.1016/j.identj.2021.06.005

dental health professionals can improve and maintain the oral and general health of their patients. Unfortunately, it makes little reference to the environmental impact of such interventions.

All community-level caries prevention programmes have an associated environmental cost, however a recent study has found that, when comparing community-level caries prevention programmes, water fluoridation had the lowest environmental impact[27]. Community water fluoridation (CWF) is a well-evidenced prevention therapy with demonstrable reductions in dental caries across the globe. Current fluoridation processes in the UK face many difficulties. To combat these, the water fluoridation clause in the Health and Care Act 2022 allows the government to take direct responsibility for fluoridation schemes. Active engagement by the dental team in subsequent local fluoridation consultations and processes is encouraged, and CWF resources are available for Local Dental Network Chairs from the FutureNHS platform. Water fluoridation is an effective and safe public health intervention recommended by the World Health Organisation that would benefit both adults and children, reduce oral health inequalities, offer a significant return on investment and likely cause the least harm to the environment.

Integrating primary care and Green Plans

The nature, prevalence and meaning of health and disease have changed in recent years, and so has the context for sustainable development. Health services now increasingly deal with multisystem risk factors for chronic diseases that define the modern world, and yet many systems comprise individual silos of specialist health areas operating independently.

To achieve quality, patient-centred care, all stakeholders across the system need to connect, collaborate and integrate operations. This rings true for both public and private sectors, including patients, carers, the whole dental team, primary and secondary care teams, suppliers, manufacturers, regulatory and governance bodies, financial authorities, and educators. Integrated care is about the effective combination and collaboration of these component parts. If prevention, patient empowerment, lean service delivery and low carbon options are fully integrated, care quality improves, patient outcomes improve, and carbon emissions are reduced.

As NHS England evolves from Clinical Commissioning Groups (CCGs) to Integrated Care Systems (ICSs), Integrated Care Boards (ICBs) will take on the NHS commissioning functions of CCGs as well as some of NHS England's commissioning functions. They will also be accountable for NHS spend and performance within the system. As per the Health and Social Care Act 2022 and the updated 2021/22 NHS England Standard Contract, both NHS trusts and ICSs are each required to formulate

[27] Duane, B. et al. 2022. https://doi.org/10.1038/s41415-022-4251-5

a Green Plan setting out carbon reduction strategies up to the year 2025. Each ICS was asked to develop a consolidated system-wide Green Plan by 31 March 2022, to be peer reviewed regionally and subsequently published.

Here is a real opportunity for ICSs to agitate the status quo and put dentistry back on the agenda. Effective, sustainable oral health and dental care should be included and embedded into primary care strategies and Green Plans. If you work for a Trust, or provide services for an ICS, it is encouraged that you contact your Primary Care Networks and review your relevant Green Plan.

Supportive organisations such as the British Dental Association or the College of General Dentistry could produce guidance to assist independent businesses commissioned to perform and provide NHS dentistry. This guidance, in line with UK Government recommendations, could enable the formation of individual Green Plans, or to ensure that these practices are operating in line with the ICS Green Plan.

For the private sector, there are no such Green Plan policy mandates, and no current regulatory requirements to engage in the sustainability agenda.

Patient recall

Good dentistry maintains oral health and prevents disease, offering high quality interventions with lasting results, only when necessary. Combining managed treatment appointments (smart treatment combinations and shared family appointments) with appropriate and safe use of complementary technologies (see section: “Digitisation”), such as teledentistry and remote clinical consultations, reduces the need for dental visits. A balance can be struck between attendance, risk of disease, quality of life and environmental impact by following NICE Clinical Guideline 19 *Dental checks: interviews between oral health reviews*, and tailoring intervals between oral health reviews based on individual risk assessment. This is practicing sustainably.

Minimum intervention dentistry

For sustainability, the modern medical approach known as minimum intervention dentistry (MID) is an appropriate management technique and skillset that moves the focus away from restoration of teeth. MID principles allow the dental care professional to achieve maximum intervention with minimally invasive treatments. Effective implementation of MID involves integrating four core principles, demonstrated in Figure 6[28].

[28] Walsh, LJ & Brostek, AM. 2013. https://doi.org/10.1111/adj.12045

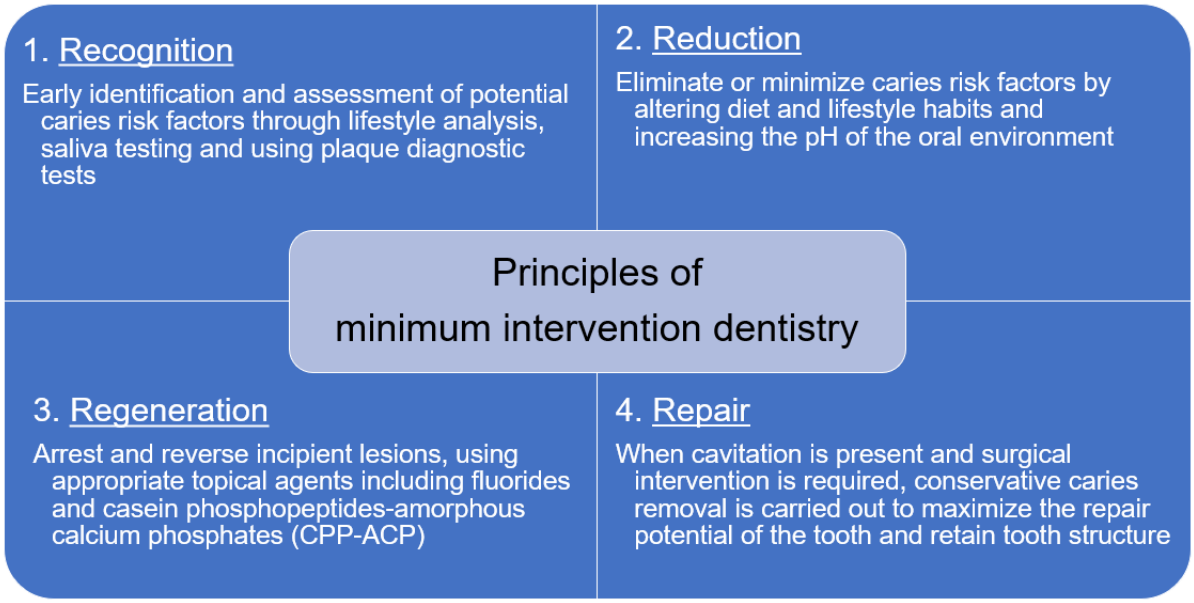

Figure 6: The four core principles of minimum intervention dentistry (MID). Source: adapted from Walsh and Brostek (2013).

After following the core principles there are likely to be patients who still require restorative treatment. Durable, high-quality operative interventions that will require fewer repairs and replacements are important factors to consider. As a result of increased longevity of restorations, carbon emissions are reduced through fewer patient journeys, reduced need for manufacturing and packaging of materials, and reduced waste and pollution.

Pharmaceuticals and prescribing

Antimicrobials

Medicines including antibiotics, pose a significant environmental problem. This occurs in two ways: spread of antimicrobial resistance, and production and waste management. Around 66% of antibiotics prescribed in the dental setting are not clinically indicated[29], dentists should not underestimate their contribution to this issue.

In some countries, there is considerable environmental pollution generated during antibiotic production[30] in the form of pharmaceutical waste. Antibiotics are released into the environment in the form of urine and faeces which accumulate in soil and water, affecting bacterial growth. In addition, inappropriate disposal of unused antibiotics can contribute to adverse environmental impacts.

Climate change is resulting in altered distribution, incidence, and intensity of disease. As temperature increases, so do the percentages of resistance bacteria[31]. Growing

[29] Sukumar, S. et al. 2019. https://doi.org/10.1111/adj.12727
[30] Limmathurotsakul, D. et al. 2019. https://doi.org/10.1093/jac/dkz185
[31] Rodríguez-Verdugo, A. et al. 2020. https://doi.org/10.1016/j.isci.2020.101024

antimicrobial resistance (AMR) is an increasing risk to public health. The intersection of climate change and AMR will become a major concern over the coming years[32].

The UK Government has developed a five-year national action plan on AMR with a strong environmental focus. The Dental antimicrobial stewardship toolkit, aims to influence the attitudes of prescribers and patients to enable and support optimal antibiotic prescribing. Pharmacies in the UK accept returns of unused medications from the public and practitioners, to allow safe disposal. There needs to be significant input from both private and public sector to improve granularity of prescribing data and behaviours across primary care.

Nitrous oxide

Nitrous oxide (N_2O) has been a valued medicine since its recognition by the American Dental Association in 1864 as an analgesic for performing oral surgery. Unfortunately, N_2O is also a powerful climate pollutant 298 times more damaging than carbon dioxide[33]. Extensive work is being done to reduce wastage of this pharmaceutical leaking from piped systems across the UK[34].

N_2O remains a safe and effective anxiolytic adjunct for dental treatment in appropriate clinical settings[35] and can prevent patients from undergoing a general anaesthetic to fulfil their treatment needs. It is important that dental prescribers are cognisant of the efforts to reduce the impact of N_2O in different disciplines across healthcare and are consulted when services are reviewing management of this medicine[36].

Dental materials and procurement

There is significant potential for financial savings to be made concurrently with environmental impact reduction when considering materials used by the dental team[37].

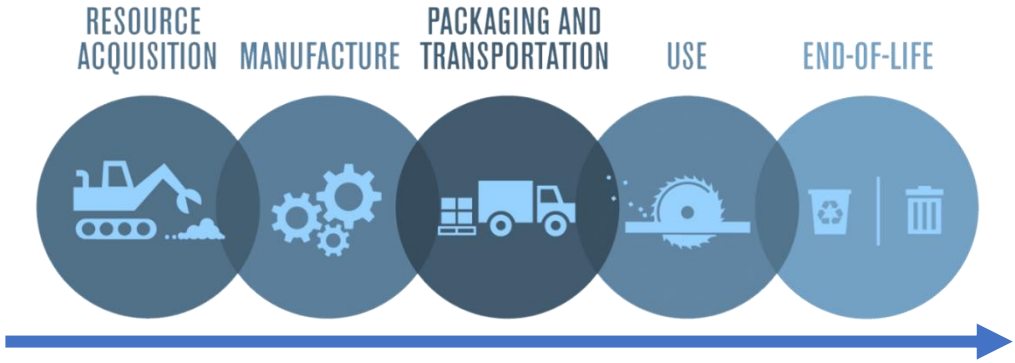

Figure 7: Lifecycle analysis diagram illustrating each area of an item's lifecycle, each stage of which is examined and assessed to calculate cumulative environmental impact of a product. Source: metadna.ca (2022).

[32] https://siwi.org/wp-content/uploads/2020/02/reducing-emissions-from-antibiotic-production.pdf
[33] https://unfccc.int/process-and-meetings/transparency-and-reporting/greenhouse-gas-data/frequently-asked-questions/global-warming-potentials-ipcc-fourth-assessment-report
[34] https://anaesthetists.org/Home/Resources-publications/Environment/Nitrous-oxide-project
[35] https://www.england.nhs.uk/long-read/clinical-guide-for-dental-anxiety-management/
[36] https://www.england.nhs.uk/long-read/guidance-on-minimising-time-weighted-exposure-to-nitrous-oxide-in-healthcare-settings-in-england/
[37] https://www.nature.com/articles/sj.bdj.2016.55

In our current economy, we take materials from the Earth, make products from them, and eventually throw them away as waste – the process is linear, as shown in Figure 7. In a circular economy, by contrast, we stop waste being produced in the first place as much as possible (Figure 8).

The environmental sustainability of materials starts with the extraction of raw resources and the manufacturing process of products. A crucial element of product manufacture is the human rights of the people whose labour is producing those raw resources and final products[38]. Consideration of the procurement of equipment, materials, and sundries from the country of origin and shipping patterns of said products is also required. Furthermore, appraising the efficacy and acceptability of materials in patient-centred care is vital for clinical practice; the sustainability of a product culminates in minimising the impact of disposal of items as biomedical waste.

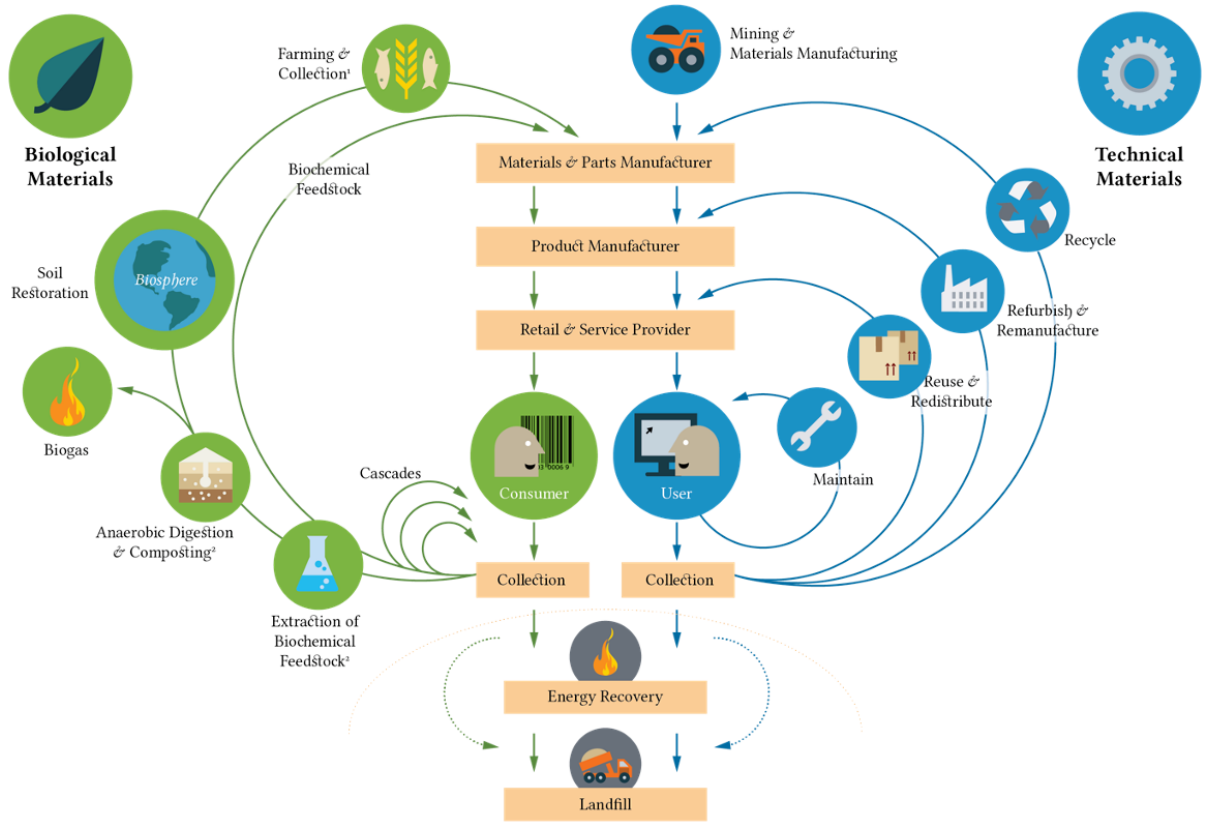

Figure 8: Stages of a circular economy. Source: Ellen MacArthur Foundation 2012.

Dental materials have a high pollution impact at each stage of their lifecycle, including raw material synthesis, manufacturing, distribution, procurement, clinical use and waste management. These stages are evaluated as part of lifecycle analyses, as

[38] Feinmann, J. 2020. https://doi.org/10.1136/bmj.m1676

demonstrated in Figure 7[39]. We have seen the contribution to the dental carbon footprint made by procuring such materials in the carbon modelling report.

Example materials and considerations

Dental material	Environmental considerations
Amalgam	• Possibly the most widely known dental restorative material with clear environmental hazards. • Commitment to phase down of dental amalgam by 2030 in the form of global legally binding treaty: Minamata Convention on Mercury of 2013 • UK restrictions already introduced, which prevents use in deciduous teeth and pregnant or breastfeeding women unless there are specific medical needs. • Amalgam separators are a mandatory requirement for all dental practices, meeting ISO 11143, removing 95% of waste amalgam - applies to all separators installed from Jan 2018. • Practices must also demonstrate use of authorised waste management establishments for handling and disposal of amalgam waste.
Resin-based composites	• Highlighted as posing environmental concerns, especially in relation to microplastics and recognised toxicity of chemical constituents[40][41].
Gypsum	• Requires specific waste management strategies due to its formation of poisonous hydrogen sulphide gas if disposed of in landfill[42]. • It is claimed that recycled gypsum powder is 99% as good as virgin gypsum[43].
Lead	• Lead foil from radiographic films is toxic and can persist in soil for many years, continuing to exert adverse health effects
Disinfectants	• Can enter water systems, causing toxicity to aquatic life, accumulating, and contributing to drug resistance[44].
Single-use plastic	• Creation and disposal of instruments, day-to-day items, PPE • Microplastic have been found both in human blood [45] and crossing the placental barrier[46].

This selection of dental materials and their impacts is not exhaustive. There is a significant gap in the knowledge base around impact-benefit analysis of materials such as composite, as well as the associated packaging for the multitude of brands

[39] https://metadna.ca/wordpress/?p=644&p=644
[40] Hatton, P. et al. 2022 https://doi.org/10.1038/s41415-022-4198-6
[41] Mulligan, S. et al. 2017. https://doi.org/10.1038/sj.bdj.2018.229
[42] Martin N, et al. 2021. https://doi.org/10.1016/j.jdent.2021.103737
[43] Arora, S. et al. 2017. https://doi.org/10.4103/2277-4696.205446
[44] https://noharm-europe.org/sites/default/files/documents-files/6599/2020-11-25-Promoting-safer-disinfectants-in-the-healthcare-sector_WEB.pdf
[45] Leslie, HA. Et al. 2022. https://doi.org/10.1016/j.envint.2022.107199
[46] Ragusa, A. et al. 2021. https://doi.org/10.1016/j.envint.2020.106274

available. Please refer to the key publications listed in Appendix 41 for further information.

Procuring dental products

The dental team has significant influence over the materials and equipment available from industry suppliers. Accounting for nearly 20% of the dental carbon footprint (Figure 2), the process of procuring dental products needs to consider the ethics of the global supply chain, stock management, product material, and packaging[47]. Consumer opinion in dental care matters; a recent study has found that patients may be more willing to compromise the time, convenience and durability of dental treatment to reduce the impact of their dental work on the environment[48]. Highlighting the values of patients and professionals to industry, and vocalising preference for the credibility of products can change the direction of manufacturing.

Future potential

Active and coordinated engagement of all stakeholders in the supply chain is vital for progress to be made towards a circular economy, one that tackles global challenges like climate change, biodiversity loss, waste, and pollution.

Growing areas of research include lifecycle analyses of commonly used dental products and dental procedures, to support clinicians in making informed, sustainable, environmentally friendly choices in both products and usage patterns. Work is ongoing to identify novel sustainable material alternatives. For example, chitosan (shellfish-based) and polyvinyl alcohol (PVOH) are being investigated as plastic alternatives[23].

Schemes have been trialled to encourage the repurposing or recycling of dental instruments[49] although these are currently not available within the UK. An example of UK-based dental recycling charity is Gold for Kids, who seek to collect metals removed or discarded after use in restorations. After specialised melting, the resulting scrap metal is then sold, with proceeds going to children's charities across the UK.

The following case study from NHS Scotland describes how streamlining the catalogue of products can assist dental practices to make better choices and financial savings.

In summary, there is a clear need for greater transparency by industry manufacturers and suppliers of the journey made by a single dental product. Developing a framework to standardise the metrics, reporting, and advertising of environmental credentials of products will help professionals make informed and sustainable choices.

[47] Duane, B. et al. 2019. https://doi.org/10.1038/s41415-019-0080-6
[48] Baird, H.M., et al. 2022. https://doi.org/10.1038/s41415-022-4910-6
[49] https://www.swallowdental.co.uk/news/trade-your-old-hand-instruments-for-new-and-help-save-the-planet/

Case Study: Dental product procurement activity across central National Services Scotland

Background

National Services Scotland (NSS) manage DenPro, a buying group supporting 400 NHS dental practices in Scotland. NSS can influence dental product procurement to make it more environmentally sustainable. There were 17 separate cups available for purchase in the DENPRO catalogue, of which only one of which was recyclable.

Aim of NSS DenPro

Move 400 dental practices from “white disposable cups” (compressed polystyrene) to “see through plastic cups” (polypropylethylene). The plastic from these cups is captured and sent for recycling.

Methods: Reducing variability in the DenPro catalogue

Initially, the catalogue was updated to include a RAG rating system for cups. Each product was labelled: red – cannot be recycled; amber – could be recycled, not practical or financially viable; green – recyclable product. Unfortunately, this exercise delivered no change in behaviour. The second phase of change involved restricting access to all non-recyclable cups in the catalogue and reducing the price of the recyclable cups.

Measurement and Results

The choice of cups was reduced in number from 17 to one, and the material of cup was changed from a non-recyclable material to a recyclable one. Financial savings were made by practices purchasing cheaper cups, and the recycled plastic contributes to payments made for waste collections for participating practices.

Conclusion and Reflection

NHS NSS are determined to deliver structural changes to its services to support the delivery of NHS dentistry in Scotland within the context of the climate crisis. From national waste management services, procurement and delivery of personal protective equipment to the ordering of sundries and materials, NSS aims to make evidence-based, environmentally beneficial systemic changes that do not financially penalise dental practices. NSS hopes to learn and build on both its successes and failures when navigating the sustainability agenda, moving beyond plastic.

This DenPro catalogue change engaged dental practices and instilled a sense positive contribution towards Scotland’s climate ambitions. This case study demonstrates how a structured, top-down approach to a complex issue in a large system can assist individual practices to make better choices.

Further information

Please read ‘Closing the circle’ from Scottish Dental Magazine.

Workplace

This document does not focus on the tangible waste, physical estates or facilities of practices and buildings, but describes a business case study for incorporating sustainable value into the business model below. Please see Appendix 3 to be directed to the published evidence regarding the workplace.

Case Study: Corporate dentistry with Clyde Munro Dental Group

Background

Clyde Munro Dental Group in Scotland is committed to developing innovative solutions and driving positive change to become Scotland's environmentally friendly dentist. With over 65 practices, this organisation is taking responsibility for the impact of its business on society and the natural environment.

Approach to sustainability in dentistry

Many of the changes implemented by Clyde Munro are easily replicable, cost very little (if at all) and can actually lead to financial savings and improved business efficiency:

- Addressing building energy needs: ongoing process ensuring every practice switches to renewable energy providers at contract renewal, and upgrading fixtures while changing behaviours
- Going paperless: digitising communications where appropriate
- Implementing new cup protocol: cups only used for rinsing upon patient request, and investment into research the most sustainable cup option
- Identifying recycling partners and incentivising participation: all practices participate in the Philips Dental Care Recycling Programme which, in partnership with TerraCycle, accepts hard to recycle items. Patients and the general public are invited to deposit used items and collect points for returned waste which can be redeemed as charity donations
- Digital scanners: aiming to introduce digital scanners into all practices by 2023
- Electric vehicles: investing in electric 'pool cars' and vans
- Eco-Champions Programme: champions steward environmental improvement and a dedicated team of clinicians are involved in trialling and reviewing alternative products, materials and protocols
- Learning: Sharing the lessons learned, both internally and externally, is a way to help drive industry change and build collective knowledge.

Results

By the end of year 2021-22, approximately 80% of our practices were powered by a renewable source and Clyde Munro saved over 470,000 sheets of paper by going digital. Cup usage has reduced by 50% across the Group. Digital scanners aim to improve patient oral healthcare, reducing restorative treatments, and to reduce the volume of materials used to lower the emissions generated through patient and lab travel. The fleet of electric vehicles and strategically positioned EV charge points has helped to replace over 2,000 petrol or diesel miles per week with lower emission electric ones. For further information, find out more here.

Conclusion and reflection

To change long-standing habits such as changing automatic purchasing behaviours or the type of bin being used, it's important to involve the team during the decision-making process. Reverting to the old way of doing things is likely and at times expected, so it's important to have patience as teams adjust to the new way of doing things. Hear and value individual opinions and empower teams by training – this should be ongoing with refresher sessions and communication reminders.

What about system-level change in oral health and dental care?

Paying for services: why is this important for sustainability?

The provision of dentistry in the UK is spread across both private and public sectors. Remunerating oral health prevention and promotion, and high value interventions and treatments are paramount to the sustainability agenda.

Private services

Currently, there lacks infrastructure across the private sector to embed, incentivise and monitor environmentally sustainable, commercially successful practice.

Much more research, engagement and guidance are needed for this part of the system.

Commissioning publicly funded services

Commissioning is the continual process of planning, agreeing and monitoring services. Commissioning is not one action but many, ranging from the health-needs assessment for a population, through to the clinical design of patient pathways, to service specification and contract negotiation or procurement, with continuous quality assessment.

Dentistry is part of primary care, and we stand before a timely opportunity, amidst ongoing dental system reform, to counteract the decline of NHS dentistry by positioning it in the wider frame of healthcare commissioning. Oral health and dental care commissioning across the UK needs to put the mouth back into the body of current and future populations.

Business as usual is no longer an option: environmental sustainability must be included in NHS oral health and dental commissioning as standard in line with the NHS policy mandate. It is crucial that individuals and groups responsible for the commissioning and arranging of all place-based primary care services do not just include dentistry, but seize the momentum for agile, flexible, conscientious purchasing.

As England's ICSs adhere to requirements to produce Green Plans, and all NHS procurement tenders detail how they contribute both to social value and fighting climate change at the earliest convenience, there is huge opportunity here. There is great potential to enforce strategic intent on providers, and to direct the flow of funding and resources towards socially and environmentally responsible products and services in oral health and dental care.

Reframing the commissioning system, protocols and assessment of fund allocation could also tackle oral health inequalities that are ever widening. Commissioning

models need to reward and incentivise general dental practices to deliver services in a sustainable way that supports the sector to reduce its carbon emissions and protect the health of the current and future communities they serve.

The Green Impact in Dentistry audit tool is a practical tool that provides clear guidance to primary care dental teams on easy and manageable actions that can be taken to reduce their carbon footprint – please see the following case study.

Public Health Wales has adopted the Green Impact tool to help the full complement of independent primary care contractors (general practices, community pharmacies, optometric practices and dental practices) improve their sustainability and environmental impact as of 2022.

Lamentably, English funding is inconsistent, but national and regional commissioners could play a significant role in system leadership by reinvigorating this relatively cheap, convenient and successful toolkit. The subsequent evaluation cycles and pooling of experience and resources would generate contemporary research and further support development of sustainable options, building community conversation and raising profiles of participating teams and regions. The toolkit can easily be adapted and updated as new evidence emerges, offering agility to commissioners and increased flexibility. Key recommendations for primary care and dental commissioners are made in Appendix 4.

Case Study: Green Impact in Dentistry Toolkit

What is the Green Impact in Dentistry Toolkit?

Green Impact is an environmental sustainability behaviour change tool comprising an award and learning framework to engage and motivate organisations from all sectors, including healthcare. Delivered by SOS-UK, Green Impact for Dentistry (GID) was developed as a bespoke toolkit for the dental sector following hugely successful programmes in General Medical Practice.

Aims of the Green Impact in Dentistry Toolkit

Green Impact in Dentistry supports teams to embed sustainability strategically within their practices, champion health and wellbeing, and connect with others across the sector.

- Make the journey towards a sustainable healthcare business as easy as possible
- Provide an easily accessible online toolkit of practical sustainability actions, specifically researched, written and evidenced for the dental sector
- Cascade research tips, best practice, and feedback between participating practices
- Offer opportunities to capture, recognise and publicly reward great work

Methods: pilot success for the East of England region and beyond

Green Impact for Dentistry was commissioned and piloted in the East of England area in 2019. The generic tool was adapted to incorporate the latest evidence and research, with students trained to assess practices against the quality assured metrics. The scheme was offered free to any dental team across the UK, but practices in the funding region were eligible for assessment and awards.

Measurement and results

With minimal advertising, 60 dental teams across the UK registered on the Green Impact toolkit and completed 674 cumulative positive sustainability actions to date, including actions pertaining to clinical choices. The teams were audited by a group of 10 volunteer undergraduate students, who received training and support from SOS-UK, offering new relationships and social value. The pilot summary demonstrates positive feedback, including financial savings, from both practices and students, and the 15 special awards categories have great potential to expand in line with future funding opportunities.

Conclusion and reflection

Creating the community support with feedback mechanisms was vital to its success. Patients and staff involved felt it brought people together. This scheme requires minimal investment and ongoing funding to implement, and adaptation of the toolkit for allied dental care professionals across community and laboratory services would allow collaborative effort across the dental sector.

Further resources

Please visit www.greenimpact.org.uk/dentists to browse the current iteration of the toolkit and sign up to join the accreditation scheme.

Education

Why education is important for sustainability

Once inspired to instigate change, people need to feel empowered. Knowledge and understanding are key to making progress in environmental sustainability.

Education for sustainable healthcare is defined as 'the process of equipping current and future health professionals with the knowledge, values, confidence, and capacity to provide environmentally sustainable services through health professions education'. This is a lifelong learning process that comprises undergraduate and postgraduate education and continuing professional development (CPD).

Education for dental care professionals in the UK

The General Dental Council (GDC) is responsible for setting the learning outcomes outlining the knowledge, skills, attitudes, and behaviours expected from registered dental professionals; these are articulated in the Preparing for Practice document. Pre-registration education providers set up and deliver the curricula and training courses.

NHS England Workforce Training Education Directorate (formerly Health Education England) is responsible for the design, planning and delivery of education and training for the NHS healthcare workforce. This plays a vital role in the collective ability of the healthcare and specifically, dental profession, in tackling the crisis. With a four-nation approach, NHS Education for Scotland (NES), Health Education and Improvement Wales (HEIW) and Department of Health in Northern Ireland serve similar roles in their respective regions.

Current education activities in sustainable healthcare

Sustainability is becoming increasingly visible within education. Healthcare faculty are increasingly seeing the need to educate on planetary health and sustainable healthcare. The Planetary Health Report Card initiative is an institutional advocacy tool originally developed by medical students. This has since spread to other UK professional groups including nursing and pharmacy. Use within UK Higher Education Institutes (HEI's) demonstrates rising demand from younger generations of clinicians, that their education prepares them to work in environmentally sustainable ways, and increasingly holding their faculties and HEI's to account.

The UK General Medical Council requires new graduates to be able to apply the principles, methods and knowledge of sustainable healthcare to medical practice. These themes are becoming integrated into undergraduate education, as demonstrated by Lancaster Medical School. The Academy of Medical Royal Colleges (AOMRC) publication Global Health Capabilities for UK Health Professionals, includes environmental, social and economic determinants of health. The aim is to incorporate these capabilities into postgraduate specialty training curricula.

Following COP26, Health Education England (HEE) made a commitment to educate every future clinician about sustainability, developing their online training modules 'Environmentally sustainable healthcare' and 'Environmental sustainability in dentistry' – freely accessible to anyone with an NHS email address, or OpenAthens account. In the North East, HEE developed the Faculty of Sustainable Healthcare, to increase awareness of sustainability and embed good practice across the local area, helping organisations achieve climate impact reduction targets.

Future potential for education activities in sustainable oral health and dental care

Awareness of the importance of sustainability in dentistry is gradually increasing. However, unlike other professions, sustainable healthcare is not currently included within UK undergraduate or postgraduate dental curricula.

The Association for Dental Education in Europe (ADEE) has explored how sustainability could be included within dental curricula and found a widespread need for teaching materials matching the four principles of sustainable healthcare[50]. As a result of this, the ADEE have worked with experts to develop a series of learning outcomes, pending publication, which can be embedded within the Graduating European Dentist (GED) curriculum.

Free educational events organised by the Office of the Chief Dental Officer (OCDO), and ProDentalCPD have begun to highlight the need for sustainable education and practice within UK dentistry.

UK Dental Curricula must follow in the same direction and embed sustainability within undergraduate and postgraduate education for all members of the oral health team. This includes curricula developed by Specialist Advisory Groups, and the support and ratification of postgraduate bodies and deans. Students want, and demand, that sustainability be addressed in their education and careers[51], and research has shown how faculties and students can work together to develop these learning materials[52].

The GDC consultation on *'The Safe Practitioner: A framework of behaviours and outcomes for dental professional education'* in January 2023 proposed inclusion of

[50] Duane B, et al. 2021. https://doi.org/10.1111/eje.12631
[51] Tun, SYM. 2019. https://doi.org/10.1080/0142159X.2019.1623870
[52] Tun, SYM. 2020. https://doi.org/10.1080/0142159X.2020.1796950

environmental sustainability as part of undergraduate learning outcomes for all members of the dental team.

While both public sector and private practitioners are beholden to the continuing professional development requirements stipulated by the GDC, there is no recommended nor compulsory element with regards to knowledge of the health implications and impact on the climate crisis.

Supporting dental professionals to develop their awareness and understanding of adopting sustainable practices and joining the wider healthcare community in responding to the climate crisis will send a clear message to our patients and the public. Key recommendations for educators are made in Appendix 4.

Regulation

Why regulation is important for sustainability

The provision of dentistry in the UK is spread across both private and public sectors, with regulatory bodies helping to provide assurance on the safety and effectiveness of care. Across the world, the appropriate role of government in the planning and delivery of public services has been the subject of intense debate: how should the state control the provision of public services and how far should markets be allowed to determine the provision of those services?[53] One answer to these questions is 'regulation' i.e., the creation of mechanisms that allow governments to influence the behaviour of healthcare professionals and autonomous service providers.

Health and social care professions are regulated to protect the public from harm arising as a result of care provided by health and social care services[54]. A lack of consideration for environmental sustainability in regulatory processes is indirectly contributing to the harmful effects of climate change due to a lack of accountability. The public are equally concerned about the health impacts of climate change, considering climate change to be as big a threat to their own health as accidents, injuries and mental health problems[55].

[53] https://www.kingsfund.org.uk/publications/how-regulate-health-care-england
[54] https://www.gov.uk/government/consultations/healthcare-regulation-deciding-when-statutory-regulation-is-appropriate/healthcare-regulation-deciding-when-statutory-regulation-is-appropriate
[55] https://www.health.org.uk/publications/long-reads/going-green-what-do-the-public-think-about-the-nhs-and-climate-change

Inaction will perpetuate the harmful consequences of the climate crisis that UK and overseas populations are already experiencing. There is huge opportunity here for regulation to lead and influence positive system change, and to contribute by embedding, inspecting and monitoring environmentally sustainable, safe, effective performer and provider practice.

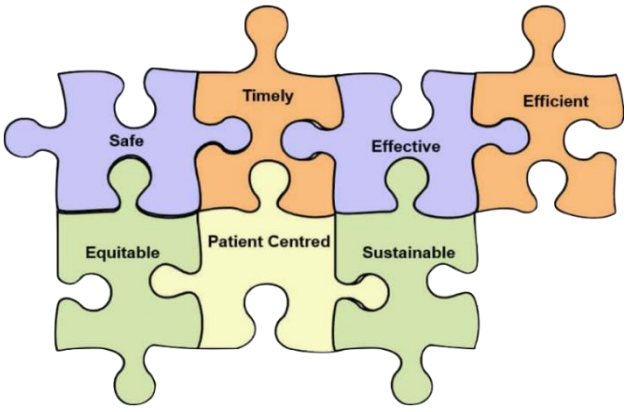

Figure 9: The Royal College of Physicians' approach to quality healthcare. Source: Royal College of Physicians.

Current regulatory activities in sustainable healthcare

Sustainability is now considered an integral part of quality in healthcare by the Royal College of Physicians (RCP)[56] (Figure 9). RCP states that 'healthcare should be considered not only in terms of what can be delivered to an individual today, but also to the population in general and the patients of the future.'[57] The General Medical Council is considering the impact it makes[58], and recognises that action on climate change is a matter for medical regulators[59].

Care Quality Commission (CQC), the independent regulator of health and social care in England, uses adherence to Health Technical Memorandum 01-05 as good evidence of compliance with infection, prevention and control measures. Dental professionals purport difficultly implementing environmental initiatives due to constraints of adhering to HTM guidance[60,61]. A review of this guidance through an environmental lens has been published in the British Dental Journal[62].

Future potential for education activities in sustainable healthcare

The CQC is changing the way it regulates and operates by moving to a single assessment framework: one set of questions used to assess every kind of provider. Within this framework, they have committed to include quality statements focussing specifically on the provision of sustainable healthcare[63]. Sharing this approach with the regulators of the devolved nations (Healthcare Inspectorate Wales, Healthcare Improvement Scotland and The Regulation and Quality Improvement Authority in Northern Ireland) will help to spread and scale the regulatory response across the UK. This new framework could offer the checks and balances for the sustainability agenda across both public and private sector providers. John Milne, Senior Clinical Advisor at

[56] Mortimer, F. et al. 2018. https://doi.org/10.7861%2Ffuturehosp.5-2-88
[57] https://www.rcplondon.ac.uk/defining-rcp-s-approach-quality
[58] https://www.gmc-uk.org/about/how-we-work/our-values/corporate-social-responsibility
[59] https://gmcuk.wordpress.com/2021/11/05/tackling-climate-change-even-regulators-have-roles-to-play/
[60] https://www.readkong.com/page/jida-volume-65-number-1-wooden-it-be-nice-8309014
[61] Grose, J et al. 2016. https://doi.org/10.1038/sj.bdj.2016.136
[62] Duane et al. 2022. https://doi.org/10.1038/s41415-022-4903-5
[63] https://www.cqc.org.uk/about-us/how-we-will-regulate/five-key-questions-and-quality-statements

the CQC 2015-2023, sought to reassure colleagues in March 2023 that, “If a process is safe and sustainable it is unlikely to put a provider in breach of CQC regulation.”

The GDC has been engaging in conversations regarding the climate crisis, and discussing commitments made by other healthcare professions. We look forward to seeing how the professional regulator contributes to the progress of the sustainability agenda. Key recommendations for regulators are made in Appendix 4.

Digitisation

Why digitisation is important for sustainability

Harnessing existing digital technology and systems to streamline service delivery provides a key opportunity to reduce the environmental impact of health and care services. Appropriate use of technology can improve the efficiency of clinical services, offer an alternative route to access care, and can reduce costs and carbon footprint when used effectively[64]. However, artificial intelligence developed to improve digital dental care, such as scanning, imaging and designing, requires further evidence of efficacy and reliability before full adoption across the sector.

Furthermore, digital and virtual systems still have an environmental impact, therefore careful consideration needs to be given to the value of digitally enabled transformation and teledentistry regarding patient outcomes, appropriate and sustainable procurement, collaborative development and implementation.

Lastly, with rapidly evolving digital innovation, it is also imperative that we prevent digital exclusion to avoid the unintentional consequence of widening existing health inequalities and remain cognisant to the digital readiness of the profession, offering appropriate support and technology infrastructure upgrades where required.

Publicly funded services

As part of their commitment to developing sustainable digital services, NHS organisations are working with the Greener NHS programme to align their sustainability strategies to deliver the ambitious NHS ‘Net Zero’ targets.

The NHS Digital Social Value Charter also includes themes on tackling economic inequality, ethical procurement, and equal opportunity, which all impact sustainability.

Furthermore, the NHS Long Term Plan commits to digital transformation to improve how the NHS delivers its services in a new and modern way, providing faster, safer and more convenient care. One such example is a solution that allows authorised clinical staff access to necessary clinical information at the point of care, improving patient outcomes. GP Connect Access Record: HTML has been successfully rolled

[64] Purohit, A et al. 2021. https://doi.org/10.7861%2Ffhj.2020-0080

out for services such as NHS 111 and hospital trusts and work is currently ongoing to extend its use into other care systems.

Workstreams that seek to reduce the environmental impact of digital health services have also commenced. For example, NHS Digital developed a cloud migration system that allows information such as emails and electronic referrals (e-RS) to be stored online using cloud services. This same system has enabled NHS 111 Directory of Services to transition to an online cloud-based model, meaning it is now more efficient, resilient and secure, whilst offering reductions in energy and carbon usage in comparison to legacy systems.

Further work has involved the creation of a non-clinical carbon footprint calculator, which General Practices in the UK can use to identify their greenhouse gas emission hotspots. Data related to four specific areas (energy, travel, business services and procurement) can be input to generate a carbon equivalent footprint. This calculator is also highly relevant for General Dental Practices.

Progress has also been made to reduce the administrative environmental impact of dentistry. Compass is a dental contract management system for commissioners, providers, performers and practice staff[65]. Since May 2019, dental practices have been required to submit claims for new courses of treatment electronically[66]. There are additional examples of administrative processes that have also moved online[67 68]. From April 2022, questionnaires for patients accessing NHS primary dental care services in Wales are also being provided digitally, though patients can opt for a paper-based questionnaire if required[69]. These initiatives not only reduce environmental burden, but also provide system-wide benefits through more streamlined and efficient processes.

Initiatives led by national digital health organisations could enable transformation of dental services in line with the wider health and care system. Cross-sector benefits will also be realised, with clinical examples expected in the near future.

Future potential

Historically, remote consultations have been infrequently utilised in dentistry, despite a positive feasibility study prior to the COVID-19 pandemic[70]. However, the COVID-19 pandemic accelerated the use of remote consultations in primary and secondary care. As described in this report by NHS Wales, virtual consultations provide an opportunity to triage patients, empowering those with limited mobility or in rural locations, and offer advice, prevention and acclimatisation and clinically-appropriate follow-up review.

[65] https://www.nhsbsa.nhs.uk/compass
[66] https://faq.nhsbsa.nhs.uk/knowledgebase/article/KA-01798/en-us
[67] https://cms.nhsbsa.nhs.uk/sites/default/files/2021-11/Travel_and_Subsistence_Claims_Guidance_%28V0.3%29_11_2021.pdf
[68] https://pcse.england.nhs.uk/services/performers-lists/dental-performers-list-for-england/
[69] https://media.nhsbsa.nhs.uk/campaigns/patient-questionnaires-wales
[70] Martin, N. et al. 2020. https://doi.org/10.1038/s41415-020-1328-x

Applications such as AttendAnywhere endeavour to emulate an in-person appointment without the need to physically attend the practice, which can reduce the environmental impact of travelling, but also improve patient convenience, experience and system efficiencies[71] [72] [73]. The General Dental Council has produced principles that reinforce the standards expected of dental professionals in the context of remote consultations.

There are also additional technological opportunities that can promote sustainability in dentistry:

- Electronic referral systems can offer a more efficient and effective pathway to refer patients for advanced mandatory services and are available across parts of England and Wales.
- Electronic information sharing in primary care could enable authorised clinical staff access to necessary clinical information at the point of care, improving patient outcomes.
- Electronic Prescription Service (EPS), which already exists between general medical practices and pharmacies, can eventually remove the need for most paper prescriptions and offers benefits to patients, prescribers and dispensers. In 2021, over 1 billion NHS prescription items were processed, but digitisation now enables a significant proportion to be processed electronically, reducing the volume of paper used and waste generated[74] [75].
- Real Time Exemption Checking (RTEC), which already exists in pharmacy, could enable providers to automatically ascertain whether a patient has an exemption that entitles them to free or reduced-cost NHS dental services.

These initiatives offer an opportunity to improve patient care and patient safety. In addition to replacing existing paper-based processes, they contribute to reducing system inefficiencies, improving understanding of the patient journey, supporting service and population health planning, including understanding and responding to health inequalities and facilitating provider assurance and reporting. Key recommendations for digital services are made in Appendix 4.

[71] Purohit, A et al. 2021. https://doi.org/10.7861%2Ffhj.2020-0080
[72] Murthy, V. et al. 2021. https://doi.org/10.1111%2Fodi.14006
[73] Rahman, N. et al. 2020. https://doi.org/10.1038%2Fs41415-020-1919-6
[74] https://www.nhsbsa.nhs.uk/sites/default/files/2022-04/Strategy%202022-25%20%28V1%29%2004.2022.pdf
[75] https://media.nhsbsa.nhs.uk/blogs/nhsbsa-doing-our-bit-for-the-environment

Next steps

Environmental sustainability is crucial to the future of the species. It is everyone's business, and we have an opportunity and obligation as health professionals to act.

The next steps to take are to:

- Review the list of recommended actions in Appendix 4 for your professional group.
- Commit to and undertake at least three of the actions listed.
- Share your achievements and failures with your colleagues, professional bodies, Integrated Care Systems, the Greener NHS, and the OCDO.

Appendix 1: Key legislation

Legislation	Relevance
Health and Care Act 2022	• Places duties on NHS England, and all trusts, foundation trusts, and integrated care boards to contribute towards statutory emissions and environmental targets. • Requires commissioners and providers of NHS services specifically to address the net zero emissions targets. It also covers measures to adapt to any current or predicted impacts of climate change identified within the Climate Change Act 2008. • Trusts and integrated care boards (ICBs) will meet this new duty through the delivery of their localised Green Plans, and every Trust and ICB in the country now having a board-level lead.
Environment Act 2021	• Gives a legal framework for environmental governance in the UK. • Brings in measures for improvement of the environment in relation to waste, resource efficiency, air quality, water, nature and biodiversity, and conservation. • Vast majority of this Act does not make any immediate changes for organisations other than regulators. • Changes to duties for businesses and other organisations are expected in subsequent legislation made under this Act[76].
The Paris Agreement 2016	• Legally binding international treaty on climate change • Adopted by 196 parties, including the UK. • Aims to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial level.
Social Value Act 2012	• Requires people who commission public services to think about how they can also secure wider social, economic and environmental benefits. • Requires explicit evaluation of social value, needing a 10% weighting of contract value, when awarding contracts. • Describes five potential options for proving a contract's social value, one of which is 'Fighting Climate Change'.
Climate Change Act 2008	• Committed the UK to reducing its greenhouse gas emissions by 80 per cent by 2050, compared to 1990 levels. • Targets were made more ambitious in 2019: UK became first major economy to commit to a 'net zero' target requiring UK to bring all greenhouse gas emissions to net zero by 2050.

[76] https://thecompliancepeople.co.uk/updates/legal/the-environment-act-2021/

Appendix 2: Key policies

Policy (date)	Relevance
Applying net zero and social value in the procurement of NHS England goods and services (2022)	• Extends the reach of Policy Procurement Note (PPN) 06/20 by setting a clear approach to adopt and apply the principles outlined in PPN 06/20 to all commissioning and purchasing of goods and services by NHS organisations, including those acting on behalf of such commissioners and purchasers. • Stipulates all tenders, including procurement such as commissioning of NHS-funded services, to include a minimum of 10% weighting allocated to net zero and social value. • All tenders to detail how they contribute to the 'Fighting Climate Change' theme of the Social Value Act.
Core20PLUS5 (2021)	• National NHS England and NHS Improvement approach to support the reduction of health inequalities at both national and system level. • Targets the most deprived 20% of the national population, and additional groups experiencing poorer than average health excluded from the 20%. • Lists 5 areas of clinical focus: maternity, severe mental illness, chronic respiratory disease, early cancer diagnosis and hypertension case-finding.
NHS Scotland climate emergency and sustainability strategy 2022 to 2026 (2021)	• Draft climate emergency and sustainability strategy 2022 to 2026 for NHS Scotland.
NHS Wales Decarbonisation Strategy (2021)	• Developed to drive an ambitious but realistic reduction in carbon emissions from NHS Wales operations. • Sets out 46 initiatives for to decarbonise NHS Wales.
How to produce a Green Plan: A three-year strategy towards net zero (2021)	• Supports co-ordination of carbon reduction efforts across NHS England by translating national strategy into local level changes. • Explains how NHS England organisations could construct Green Plans, and the areas/initiative that plans should cover.
Delivering a 'Net Zero' National Health Service (2020)	• Takes a clear position on the climate emergency by recognising the threat climate change poses to public health and healthcare. • Outlines NHS England's position on the climate emergency and ambition to be the first net zero national health service in the world. • Describes NHS England's emission reduction targets.
Social Value Model and Procurement Policy Note (PPN) 06/20 (2020)	• Launches a new model to deliver social value through government's commercial activities. • Requires explicit evaluation of social value in all central government procurement.
NHS Long Term Plan (2019)	• Sets out NHS England's plans to: make sure everyone gets the best start in life; deliver world-class care for major health problems; support people to age well.
25 Year Environment Plan (2018)	• Sets out UK government goals for improving the environment within a generation. • Details how UK government will work with communities and businesses to achieve goals. • Describes targets for clean air, clean and plentiful water, plants and wildlife, reducing harm, resource use, waste, chemicals and biosecurity.
UN Sustainable Development Goals (2015)	• Blueprint for ending poverty and reducing inequality while simultaneously addressing the climate crisis and restoring degraded oceans and forests. • Each of the 17 Sustainable Development Goals includes detailed metrics to assess progress.

Appendix 3: Key publications and guidance

Publications

Publication (date)	Relevance
Carbon modelling within dentistry (2018)	• This report calculated and analysed the carbon footprint of 17 of the most common dental procedures, including both high volume and resource intensive treatments, and identified types of service which are responsible for large amounts of greenhouse gas emissions.
Sustainable Dentistry British Dental Journal series	• Evolving collection of articles covering energy, waste, procurement, travel, biodiversity, education.
Sustainable Dentistry: How-to guide for dental practices by the Centre for Sustainable Healthcare (2018)	• A practical guidance document offering ideas for making primary care dental practices more sustainable.

Guidance

Guidance (date)	Relevance
Clinical guidelines for environmentally sustainable dentistry (2023)	• Aims to raise awareness and understanding of the environmental effects of oral healthcare across the dental profession. • Provide standards for the profession against which they can initiate, manage and measure change in their practice. • Useful for dental / public health professionals to support the development of dental and related services.
Climate and health: applying All Our Health (2022)	• Guide for frontline health and care professionals to use their trusted relationships with patients, families and communities to reduce the contribution of the health and care system to the climate crisis.
How to produce a Green Plan: A three-year strategy towards net zero (2021)	• Explains how NHS Organisations should construct their Green Plans, and the areas and initiatives that the plan should cover.
Sustainability in Surgery by the Royal College of Surgeons of England (2021)	• Outlines organisational commitments and strategy. • Describes membership of the UK Health Alliance on Climate Change.
Sustainability in the operating theatre: a guide to good practice by the Royal College of Surgeons of England (2022)	• This guide makes practical recommendations for members of the surgical team in the areas of solid waste reduction; green purchasing; water conservation; care pathways; cultural change and surgical leadership.
Sustainability in Quality Improvement by the Centre for Sustainable Healthcare (2018)	• This method of quality improvement provides an approach to improving healthcare in a holistic way, by assessing quality and value through the lens of a “triple bottom line”, where health outcomes of a service are measured against its environmental, social, and economic costs and impacts to determine its “sustainable value”.

Appendix 4: Key actions and opportunities for change in oral health and dental care

	Should do…	Could do…
Everybody	• Accept that oral health and dental care has a duty to be sustainable. • Read and familiarise self with NHS Net Zero report. • Read and familiarise self with Carbon modelling for dentistry. • Undertake carbon literacy training, for example with The Carbon Literacy Project. • Implement environmental sustainability as permanent agenda item across the sector: in practices, organisations and corporations.	• Development of resources/learning/promotional materials to support actions/campaigns and inform patients and staff. • Inform self of local and regional initiatives looking at the wider picture of health improvement initiatives that consider sustainable value and the triple bottom line.
Dental team	• Preventative management focus; delivery of oral hygiene and diet advice, smoking and alcohol cessation as per DBOH. Provision of fluoride varnish and fissure sealants where indicated. • Adherence to NICE CG19 patient oral health checks guidance. • Adoption of minimally-invasive dentistry techniques. • Reduction of prescribing, especially antibiotics, and only prescribing required amounts. • Encourage patients to return unused medication to pharmacies for safe disposal. • Adoption of the Sustainability in Healthcare Dental Practice Guide with simple cost-effective steps to consider in addressing use of dental materials and medicines. • Buy less. • Explicitly purchase products which prove sustainable credentials from reputable sources.	• Employ or appoint a practice or organisational Sustainability Lead and Waste Management Lead. • Ensure up to date training and education/CPD is provided to all staff/team members to support understanding and engagement with safe sustainable clinical practices.
Commissioners	• Accept publicly funded services have additional duties with regards to legislation and policies. • Familiarise self with Taking Account of Social Value in the Award of Central Government Contracts by undertaking 60 mins free online training provided by the Government Commercial College. • Implement social value legislative requirement in your commissioning. • Encourage, enable and reward dental teams for operating sustainably. • Reform dental contracts to include and prioritise remuneration for low intensity preventive services and health promotion activities, preventing need for care in the first place. • Reform dental contracts to include and prioritise remuneration for high value treatment services.	• Organise and participate in networking events with your providers. • Signpost local professional and managed clinical networks to resources. • Set NHS contractual stipulations and/or targets for carbon reduction in the oral health and dental care sector. • Commission sustainable services by funding Green Impact in Dentistry Toolkit regionally, nationally or collaboratively. • Recognise environmental conscious services and operations with local and/or regional awards. • National commissioning teams monitor and evaluate progress of this agenda.

		• Establish co-location of oral health and dental care services with other primary care and community services while integrating care pathways. • Specify and commission list of sustainable oral health and dental care services for NHS contract holders. • Work with local authorities to encourage regional water fluoridation.
Educators	• Undergraduate and postgraduate dental curricula to include planetary health and sustainable healthcare; partnerships between students and educational providers will promote faculty development, co-create learning, and research opportunities, and reinforce the academic commitment to environmental sustainability in dentistry. • Develop assessment frameworks and placement learning outcomes that require evidence of learning and actioning relevant capabilities for environmental sustainability. • Stakeholders such as Colleges, professional associations, and trade unions should create a system that promotes and demonstrates the value of a multi-professional approach to tackling climate change, increasing the availability of educational resources and guidance available for dental professionals and providers. • Dental professionals should take ownership of their commitment to greener dental practice through its inclusion in personal development plans, CPD courses, peer reviews, and reflective practice. • Leadership organisations with a remit on workforce development should set standards for learning cultures and training environments that include sustainable healthcare principles.	• Investment and development of leadership opportunities by hosting future Clinical Leadership Sustainability Fellows, with a focus on developing and implementing future sustainability practices within dental organisations and the profession. • Responding to the Climate Change Act, employers, including practice owners, dental corporates, and NHS Trusts should support the learning and development of their employees in sustainable dentistry.
Regulators	• Influence professionals, providers, and other dental stakeholders by publishing guidance where appropriate, and sharing examples of good practice relevant to environmentally sustainable practice. • Transition to paperless programmes and maximise the use of virtual settings where possible to undertake regulatory activity. • Assess and understand the risks that action or inaction of adopting sustainable practice may bring to patients and the public. • Introduce regulatory requirements for oral health and dental care services to operate sustainably.	• Produce guidance for oral health and dental care services on environmentally sustainable practice which does not cause harm or contribute to the climate crisis. • Add environmentally conscious practice to the scope of professionalism.
Health, clinical and business policymakers	• Accept that health and clinical policymakers have a duty to specify the decisions, plans and actions to be undertaken to achieve net-zero oral health and dental care services. • Public health teams need to develop a national sustainable oral health and dental care framework, drawing on the published research to include environmental analysis and planetary impact.	• Publish and share examples of good environmentally sustainable practice. • Encourage, enable and reward dental teams for operating sustainably. • Organise and participate in networking events with your providers.

	• All public sector and private organisations involved in delivering oral health and dental care across the UK at a primary care level to review existing internal and external health and clinical policy to incorporate mitigation of climate and environmental impact. • Work with wider stakeholders e.g., dental associations, Local Dental Committees (LDCs), Local Dental Networks (LDNs) and Managed Clinical Networks (MCNs) to design/implementation of practice policies (reduce, reuse, recycle, rethink) and business plans to support use of sustainable materials and in a sustainable manner, or linking up with local pharmacies to assist in return of unused antibiotics/medications.	• Signpost providers to resources. • Influence professionals, providers, and other dental stakeholders to support this agenda. • Systematically review organisational operations using the environmental sustainability lens and implement changes to reduce and mitigate environmental impact.
Digital services	• Develop a national digital sustainability strategy across health and social care that describes the impact of digital transformation on achieving net-zero carbon emissions and how to achieve this ambition, with specific reference to oral health. • Implement infrastructure to facilitate interconnectivity between dental practice management systems and health and social care networks. • Co-produce technologies by engaging with the profession and public to develop effective and sustainable digital solutions. • Evaluate the digital readiness of the profession, offering appropriate support and technology infrastructure upgrades where required. • Communicate clear guidance to the profession on effectively adopting and using new technologies, including the benefits they offer.	• Establish a baseline for type and quality of ICT hardware usage in dental services to inform improvements to the lifecycle of digital devices helping to support a circular economy. • Quantify the positive environmental impact of digital transformation in dentistry.
Industry producing goods and materials	• Develop more sustainable materials, manufacturing processes and packing options. • Develop safe reusable materials and equipment. • Remove greenwashing of products and services. • Increase transparency of product manufacture. • Engage in research to build knowledge of materials impacts, development and alternative waste disposal methods.	• Suppliers and/or manufacturers to own the cradle to grave journey of products sold to dental profession. • Form links with wider system partners to develop and trial instrument donation/repurposing schemes to avoid unnecessary disposal of equipment and redirection of waste materials/alloys to other engineering areas for further use.

- End of Document –

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