Community Dental Health (2021) **38,** 15–20
Received 9 January 2020; Accepted 2 June 2020

doi:10.1922/CDH_000082020Bowden06

Evaluating the environmental impact of the Welsh national childhood oral health improvement programme, Designed to Smile

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Introduction: Designed to Smile (D2S) is a national oral health improvement programme, aimed to reduce the prevalence of dental caries in young children in Wales. D2S has a responsibility to consider the environmental impact of the service it provides and demonstrate adherence to the sustainable development principle legislated within the Wellbeing of Future Generations (Wales) Act. ***Objective***: To review the environmental impact of D2S by estimating the carbon footprint of the programme and identify carbon hotspots for future targeted action. ***Research design***: Process mapping identified the steps to deliver the supervised toothbrushing and fluoride varnish elements of D2S. Annual estimates of business travel mileage, financial spend on procurement, total number of plastic consumables and waste disposal were made. An online survey enabled calculation of staff commuting behaviour. These contributors were converted to carbon emissions using established carbon conversion factors. ***Results***: The annual carbon footprint of D2S was estimated at 388 tonnes of CO^2e (tCO^2e) with 31% attributed to staff travel, 23% to business travel and 46% to procurement. An estimated 1 million plastic items were distributed. ***Conclusion***: By promoting good oral care and preventing the need for future carbon intensive restorative dental treatments, D2S exemplifies a sustainable model of healthcare. Adopting reduce, reuse, recycle principles for plastic consumables and introducing sustainable procurement procedures could lead to further decarbonisation and reduction in plastic waste.

Keywords: *Environmental impact, carbon footprint, social responsibility, toothbrushing, programme evaluation, child oral health*

Introduction

Climate change has been declared the greatest threat to public health of the 21st century (Costello *et al*., 2009). The World Health Organisation (WHO) estimate an additional 250,000 deaths between 2030 and 2050 will result from the effects of global warming. Planetary health impacts upon human health through air pollution, lack of clean water, lack of shelter and insufficient food (WHO, 2018). Urgent international action is required (United Nations, 2018) with the UK government pledging to reduce carbon emissions by 80% by 2050 (UK Government, 2008). Healthcare provision is an important contributor to carbon emissions with 5% of the UK's total Greenhouse Gas (GHG) emissions related to NHS activity (Sustainable Development Unit, 2016). Travel associated with NHS and social care services is responsible for around 5% of UK traffic, contributing not only to GHG emissions but air pollution, accidents and noise (Sustainable Development Unit, 2020).

Dentistry is taking a leading role in sustainable health care practice by reducing the environmental impact of providing clinical services. Building on the first report of carbon footprint of dental services in 2011 (Duane *et al*., 2012), Public Health England (2018), with the Sustainable Development Unit have developed dental specific method for carbon modelling to inform planning and delivery of dental practice. Sustainable practice has a high profile, supported by the British Dental Association, with practical approaches proposed to incorporate sustainability within primary care dentistry (Duane *et al*., 2019)

Within Wales, the Wellbeing of Future Generations (Wales) Act (Welsh Government, 2015) requires all public bodies to adhere to the sustainability principle, that the needs of the present are met without compromising on the ability of future generations to meet their needs. This requires organisations to calculate and understand their overall carbon footprint and to help staff and visitors understand their personal carbon footprints. Wales has a population of over 3.1 million people with high density urban populations in southern cities and dispersed populations across rural North and Mid Wales (Welsh Government, 2020).

Designed to Smile (D2S), as the national oral health improvement programme, funded by Welsh Government and delivered by NHS Wales (Designed to Smile, 2019), must adhere to the sustainability principle. D2S provides targeted supervised toothbrushing and fluoride varnish for young children throughout Wales. Local partners in D2S were increasingly aware of planetary health and concerned about the sustainability of the programme. Plastic waste generated by the programme was of concern to parents and schools who were interested in the use of eco-friendly products such as bamboo toothbrushes as an alternative.

A sustainable healthcare system has been defined as having four underlying principles of prevention, patient self-care, lean service delivery and low carbon alternatives (Figure 1) (Mortimer, 2010).

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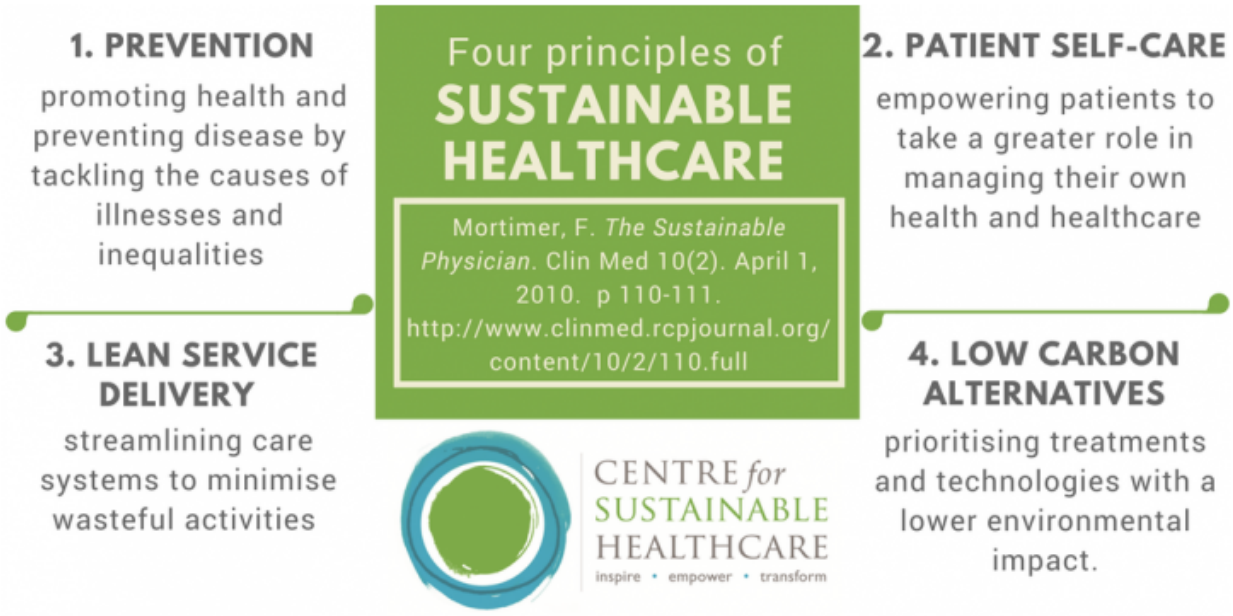

Figure 1: *Four Principles of Sustainable Healthcare*

D2S is a preventative programme that promotes self-care to avoid future intensive dental treatment. Since its inception in 2009, the national prevalence of dental caries in children has significantly reduced from 47.6% of 5 year olds in 2007/8 to 34.2% in 2015/16 (Morgan and Monaghan, 2017).

The aims of this project were to estimate the carbon footprint of D2S, identify carbon hotspots, and understand the current commuting behaviours of D2S staff. This will focus action to improve service delivery and provide low carbon alternatives, thereby addressing the two further principles of sustainable dentistry.

Methods

Determining the boundaries

A carbon footprint defines the total greenhouse gas (carbon) emissions caused directly and indirectly by a person, organisation, event or product (Carbon Trust, 2019) expressed as carbon dioxide equivalents (CO^2e). To allow standardised reporting of emissions, the Department for Environment, Food and Rural Affairs (DEFRA) produces annual conversion factors, so organisations and individuals can convert their activities, including travel, energy use, waste disposal, water consumption and recycling into the corresponding carbon emissions (DEFRA, 2018).

Process mapping of the supervised toothbrushing and fluoride varnish programmes within D2S was undertaken to identify steps in service delivery. A pragmatic approach to determining the boundaries of D2S as an organisation was adopted. D2S is delivered by Community Dental Service teams co-located in Local Health Boards (LHB) across Wales. As per GHG protocol, all LHB produce annual sustainability reports documenting carbon emissions associated with water, electricity, gas and waste disposal. To report on these emissions within this carbon footprint would be "double counting" as two organisations would be reporting the same emissions. Emissions associated with these factors were therefore not included. Pragmatically, it would not be possible to determine emissions directly related to D2S from other LHB activities. We considered the boundaries of D2S as those within direct accountability and ability to implement change.

Carbon footprinting methods can adopt a top down approach, converting the economic spend of the organisation on goods and services into carbon emissions using established carbon conversion factors (Public Health England, 2018). Alternatively, a process-based lifecycle analysis approach identifies the different stages or processes required to produce a specific good or service through its lifecycle from cradle to grave. Dental specific methods by the Sustainable Development Unit for Public Health England took a hybrid approach to produce carbon modelling for 17 common dental procedures. This analysis identified key elements of the hybrid approach, relevant to the Designed to Smile (D2S) programme. This limited the evaluation to staff commuting travel, business travel and procurement. Procurement was attributed to two main groups; consumables that included toothbrushes, toothpaste, brush buses and take home packs for the supervised toothbrushing programme and office administrative equipment that included stationary, storage and IT equipment.

Procurement

Financial spend on D2S was obtained from all seven LHBs. Carbon emissions per financial spend were calculated using the carbon conversion factor for manufacture of basic pharmaceutical products and pharmaceutical preparations for consumables and the carbon conversion factor for office administrative, office support and other business support activities for programme administration. (Public Health England, 2018).

This input-output method uses generic conversion factors to approximate carbon emissions. A lifecycle analysis approach for plastic and paper resources within the toothbrushing and fluoride varnish programmes detailed the use of consumables within D2S. The numbers of plastic and paper resources were estimated using monitoring data (Morgan, 2018) and D2S policies and procedures (Designed to Smile, 2017). Each plastic consumable and a sample bamboo toothbrush was weighed.

Carbon conversion factors (DEFRA, 2018) for plastic manufacture and waste disposal were applied to generate total kg of CO^2e. The use of recycled plastics or bamboo rather than new plastic (virgin plastic) for supplies and for waste disposal was explored using alternative conversion factors (DEFRA, 2018).

Staff commuting

A survey examined the commuting behaviour and influences of D2S staff. The survey was conducted over a 5-week period. All D2S staff were invited via email to participate in the anonymous survey, hosted by the online platform, Survey Monkey. Prospective participants were advised that their involvement in the survey was voluntary and that active participation implied consent to the use of their information in the methods described. The NHS Health Research Authority Decision Tool indicated that ethical approval was not deemed necessary as this was considered a service evaluation. The survey content related only to staff commuting behaviours i.e. travel to and from work.

If mainly travelling by car or work van, participants were asked to input their daily return home to main work base mileage, as calculated by Google™ Maps. An annual mileage for each participant was then calculated using miles travelled per week multiplied by days per week they made this trip and weeks worked per year, exclusive of annual leave.

To calculate related carbon emissions, the mileage was multiplied by the DEFRA conversion factor for business travel-land, for an average car of unknown size and unknown fuel type.

Business travel

Financial spend on business travel was identified with 0.26 of total spend attributable to mileage with the remaining 0.74 related to indirect emissions from car maintenance and repair. The total number of miles travelled was calculated from financial spend on mileage assuming each mile travelled equated to £0.45 as the standard NHS expenses rate. Carbon conversion factors for business travel-land, for an average car of unknown size and unknown fuel type were applied to total miles to establish carbon emissions (DEFRA, 2018)

Carbon emissions per child

The total carbon footprint and procurement carbon footprint was divided by the number of participating children within the D2S programme to determine the carbon emissions attributable to each child.

Results

Carbon footprint of D2S

It is estimated that 388 tonnes of CO^2e (t CO^2e) were attributable to the D2S programme in 2016/17. The greatest contributor to carbon emissions was from procurement at 179t CO^2e (46%) followed by staff commuting by car at 119t CO^2e (31%) and business travel at 90t CO^2e (23%). The carbon emissions per child (98,554 children in 2016/17) was equivalent to 3.94kg CO^2e.

Procurement

Procurement within D2S resulted in 179 t CO^2e, with consumables and dental take home packs equating to 144 t CO^2e and programme administration estimated at 35t CO^2e. The carbon emissions for procurement per child was equivalent to 1.82kg CO^2e.

Plastic consumables lifecycle analysis

We estimated that 968,638 plastic items were distributed by D2S during 2016/17, including 554,093 toothbrushes, 403391 toothpaste tubes and 11154 brush buses. The nearly 1 million plastic items used by D2S in 2016/17 had a total estimated weight of 28 tonnes.

The estimated carbon emissions from the processing, manufacture and distribution of these plastics was 86 tCO^2e. The use of open-loop recycled plastic (plastic from a different product) as the source material for the plastic consumables would reduce associated carbon emissions from 86tCO^2e to 18 tCO^2e. The use of bamboo wood for toothbrushes would lead to a 13-fold reduction from 12 tCO^2e for new plastic toothbrushes to 1.6 tCO^2e. (Table 1).

Recycling plastic items would result in 0.59 tCO^2e compared to waste disposal by landfill 0.25 tCO^2e (Table 1). More carbon emissions are generated in recycling plastic than sending to landfill due to the additional energy requirements. However, there would be a consequent reduction in the generation of new plastic products and no risk of plastic waste ending in seas and oceans. Composting 3.38 tonnes of bamboo toothbrushes would result in 0.08 tCO^2e. This is equivalent to the CO^2e release from recycled plastic toothbrushes and greater than plastic toothbrushes on landfill due to the release of methane gases. The incorrect disposal of bamboo toothbrushes to landfill would generate 3.2 tCO^2e.

Paper resources

Over 800,000 sheets of paper and 240,000 envelopes were estimated to be used within D2S in 2016/17. It is estimated that 7516 kg CO2e equivalent to 7.5 tonnes of CO^2e is produced to manufacture the quantity of paper used within the D2S programme.

Staff commuting

Across all seven Health Boards, 84 of the 143 D2S staff members (58.7%) took part in the survey.

Mode of travel was reported by 83 participants, with an overwhelming majority (96.4%) driving to work alone. Only 2.4% shared a car journey, as the driver. One participant (1.2%) walked to work. Factors that influenced staff travel behaviours included: needing their car for work (74.7%); lack of alternatives (51.8%); convenience

Table 1. Estimated carbon emissions from alternative materials

	Total weight (tonnes)	*DEFRA conversion factor for material use*	*Total manufacture GHG emissions (kg CO2e)*	*DEFRA conversion factor for waste disposal on landfill*	*Total landfill waste disposal GHG emissions (kg CO2e)*	*DEFRA conversion factor for recycle plastic/compost wood*	*Total recycled waste disposal GHG emissions (kg CO2e)*
Toothbrush							
New plastic	3.88	3119.0225 (virgin plastic)	12097.6	9	34.9	21.3842	82.9
Bamboo	3.88	416.1972 (wood)	1614.3	828.1303	3212.0	21.3842	82.9 (compost)
Recycled	3.38	656.607 (open-loop plastic)	2546.7	9	34.9	21.3842	82.9
Toothpaste tube							
New plastic	14.12	3119.022 (virgin plastic)	44036.5	9	127.1	21.3842	301.9
Recycled	14.12	656.607 (open-loop plastic)	9270.4	9	127.1	21.3842	301.9
Brush bus							
New plastic	9.48	3119.022 (virgin plastic)	29571.1	9	85.3	21.3842	202.7
Recycled	9.48	656.607 (open-loop plastic)	6225.2	9	85.3	21.3842	202.7

and comfort (30.1%) and the need for additional journeys before and after work (28.9%).

Seven participants did not provide information on distance travelled to work, leaving 76 completed responses. The average daily return journey was 18.7 miles (range 0.5 – 76 miles). The overall annual mileage was 224,460. Assuming that the survey sample is representative of the 143 D2S staff, the total annual car commute to work by D2S staff is 416,855 miles, equivalent to 17 times around the world and equating to 119tCO^2e of carbon emissions per year.

Total emissions related to business travel were 90 tCO^2e, with 34tCO^2e related to business mileage and 55tCO^2e related to indirect emissions associated with staff travel in work.

Discussion

D2S activities in 2016/17 generated an estimated 388 tCO^2e, equivalent to the annual carbon emissions generated by 48 UK households (Committee on Climate Change, 2014). This represents only 0.05% of the total carbon emissions attributed to the NHS in Wales (Welsh Government, 2011). The greatest contributor to carbon emissions was from procurement at 179tCO^2e (46%) followed by staff commuting by car at 119tCO^2e (31%) and business travel at 90tCO^2e (23%).

Within NHS dentistry services in England, patient and staff travel had the greatest contribution to carbon emissions (PHE, 2018). D2S provides a lean pathway of delivery by removing the need for patient travel. Placing the programme in nurseries and schools eliminates the need for individual patients to travel to dental surgeries for equivalent procedures. Thus the delivery of 70651 fluoride varnish applications in a school or nursery saved an estimated 170 tonnes CO^2e. In addition, reduction in patient journeys will have broader public health benefits in reducing air pollution, noise and accidents.

The prevention of oral disease is the most sustainable way to minimise the environmental impact of ensuring optimal oral health (World Dental Federation, 2017). The D2S programme promotes the concept of sustainable dentistry (Mortimer, 2010), through its focus on prevention, subsequently reducing the need for restorative, extraction and sedation treatments with a much higher carbon footprint. These data suggest that the carbon emissions per child participating in the D2S programme is 3.94kg CO^2e. This compares favourably to 151.9kg CO^2e for composite fillings with inhalational sedation (PHE, 2018) or 173kg CO^2e per operative theatre case for general anaesthetic (NICE, 2007).

The largest contributor to the carbon footprint was from procurement, replicating findings across the NHS in England (Sustainable Development Unit, 2016). Reduction in plastic waste is a real and important concern to parents and schools. Of the estimated 3.7 million tonnes of plastic produced in the UK every year (WRAP, 2016) the 28 tonnes from D2S contributes only 0.0007%, or the equivalent of the average annual plastic waste from 355 people.

Despite its positive impact at preventing carbon emissions associated with traditional delivery of dental services, the evaluation has highlighted areas for potential decarbonisation. Applying reduce and re-use principles

could impact on the number of plastic and paper consumables in several ways:

- Reducing the production of virgin plastic stock for plastic consumables through the inclusion of sustainability requirements within the tendering process.
- Switching to recycled plastic could reduce total carbon emissions by 68tCO^2e.
- Switching to bamboo toothbrushes could reduce total carbon emissions by 10.4tCO^2e
- Reducing paper documentation through utilisation of electronic methods of communicating to both schools and parents.

This analysis demonstrated that the greatest contributor to carbon emissions and plastic waste was from plastic toothpaste tubes rather than toothbrushes. Fluoride toothpaste is not currently available in the UK in packaging made from other materials. All oral care products of any brand may be recycled through a free TerraCycle recycling programme.

Bamboo toothbrushes had a lower carbon footprint to manufacture than plastics in this analysis, but this did not account for their full lifecycle, including importing, which will increase their environmental impact. Though bamboo handles are compostable the vast majority of eco-friendly toothbrushes use nylon bristles, which require removal before disposal to prevent plastic contamination of compostable waste. Disposal of bamboo toothbrushes in landfill would result in more carbon emissions than plastic products. The clinical safety and effectiveness of bamboo toothbrushes must also be considered with D2S reviewing any new evidence as it becomes available.

The staff travel survey achieved a relatively high response rate (58.7%), suggesting that the issue of staff travel may be one of significance. The nature of D2S involves field work on school or nursery visits necessitating a suitable vehicle for staff and equipment. This was evidenced by 74.7% of staff needing a car for work as an influencing factor on their choice of travel. Methods to facilitate a more coherent strategy to co-ordinate business travel within the programme could be investigated, such as a rota system for vehicles. This could reduce the need for all staff to drive to work and encourage use of public transport.

Workforce planning should account for environmental sustainability and where possible, arrangements should base individuals in locations that are easily accessible from their homes. Car sharing should be encouraged, particularly in areas with poor public transport and long rural commutes.

More accurate data on business travel during working hours would be needed to identify strategies optimise the sustainability of such transport.

Engaging staff to participate in such a survey to raise awareness of the concept of sustainability and of each person's individual responsibility towards its promotion, both in personal and professional capacities. With an ever-increasing focus on sustainability, driven by governmental policies and national initiatives designed to achieve reductions in Greenhouse Gas emissions, the consideration of the issues addressed in this survey are likely to become increasingly prevalent and important in the organisation and delivery of health services. The rationale for and results of the travel survey could be disseminated among other groups of health care professionals involved in similar community/outreach-based activities. This study may be relevant and beneficial to their own area of work, and assist in achieving compliance with the need for organisations to calculate and understand their own carbon footprint and to develop sustainable models of working.

Carbon footprinting is an emerging field within the dental sector. This analysis aimed to provide a preliminary understanding of the carbon footprint of Designed to Smile. Though every attempt was made to capture all associated carbon emissions, omissions will have occurred. Energy use, including electricity and gas, water and general waste disposal were not included due to double counting with LHBs. However, their impact is not expected to be high, with water and waste disposal comprising only 0.3% of the carbon footprint for NHS England dental procedures (PHE, 2018). Energy requirements including gas and electricity comprise a further 15.3%, however, D2S are co-located within LHBs with most of their working day outside office buildings. Identifying the proportion of energy use attributable to D2S would be very difficult. However, further studies could address this though co-production with LHB's annual sustainability reports to provide a fuller and more accurate carbon footprint for D2S.

The figures calculated for annual staff travel mileage and equivalent CO^2e rely on the assumption that the survey sample is representative of the views and behaviours of non-respondents. A variety of factors at Health Board or individual level, including the quality of local public transport services, the feasibility of alternative travel options and the perceived relevance of the survey may have contributed to staff engagement with the survey.

Conclusion

The Designed to Smile model of care exemplifies sustainable dentistry through a preventative programme that promotes self-care and lean pathway of delivery. The environmental impact of the programme must be balanced with an alternative of reactive, carbon intensive restorative treatments. However, the urgent action required to avert the extreme impacts of climate change requires a target of decarbonisation. This evaluation was the first step towards a more detailed understanding of D2S's environmental sustainability and responds to concerns about plastic waste. Initial progress has been made to introduce new practices such as reduction in paper use, introduction of sustainability requirements for tendering of new products and promotion of recycling of oral care products. These first steps in local action must be part of a broader societal level change that includes consideration of our own travel and commuting behaviour and promoting an organisational culture that supports active travel options.

Acknowledgements

Thank you to all the Designed to Smile staff that completed the survey.

References

Carbon Trust (2019): *Carbon Footprinting Guide*. Carbon Trust: Available at: https://www.carbontrust.com/resources/guides/carbon-footprinting-and-reporting/carbon-footprinting/ Last accessed 26/09/2019

Committee on Climate Change (2014): *The Fifth Carbon Budget*. Available at: https://www.theccc.org.uk/wp-content/uploads/2016/07/5CB-Infographic-FINAL-.pdf. Last accessed 22.10.2019

Costello, A., Abbas, M., Allen, A., Ball, S., Bell, S., Bellamy, R., Friel, S., Groce, N., Johnson, A., Kett, M., Lee. M., Levy, C., Maslin, M., McCoy, D., McGuire, B., Montgomery, H., Napier, D., Pagel, C., Patel, J., de Oliveira, J.A.P., Redclift, N., Rees, H., Rogger, D., Scott, J., Stephenson, J., Twigg, J. and Wolff, J. (2009): Managing the Health Effects of Climate Change: Lancet and University College London Institute for Global Health Commission. *Lancet* **373,** 1693-1733

Department for Environment, Food and Rural Affairs (2018): *Greenhouse gas reporting: conversion factors 2018*. UK Government. Available online at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018. Last accessed 08/12/2019

Designed to Smile (2019): *National Child Oral Health Improvement Programme in Wales*. Available at: http://www.designedtosmile.org/welcome-croeso/welcome/ Last accessed 03/06/19.

Designed to Smile (2017): *How to Guide: A Manual for Delivering Designed to Smile.* Cardiff: Welsh Government.

Duane, B., Harford, S., Ramasubbu, D., Stancliffe, R., Pasdeki-Clewer, E., Lomax, R., and Steinbach, I. (2019): Environmentally sustainable dentistry: a brief introduction to sustainable concepts within the dental practice. *British Dental Journal* **226,** 292-295

Duane, B., Hyland, J., Rowan. S. and Archibald. B. (2012): Taking a bite out of Scotland's dental carbon emissions in the transition to a low carbon future. *Public Health* **26,** 770-777.

Morgan, M. (2018): Designed to Smile: Activity data 2016-17 monitoring report. *Welsh Oral Health Information Unit*. Cardiff: Cardiff University.

Morgan, M. and Monaghan, N. (2017): Picture of Oral Health: Dental Caries in 5 year olds 2015/16. *Welsh Oral Health Information Unit*. Cardiff: Cardiff University.

Mortimer, F. (2010): The Sustainable Physician. *Clinical Medicine*. **10**, 110-112

National Institute of Clinical Excellence (2007): *Environmental Impact Report: Medicines Optimization*. Available online at: https://www.nice.org.uk/Media/Default/About/what-we-do/Into-practice/resource-impact-assessment/Medicines-optimisation-sustainability-report.pdf last accessed 16/10/2018

Public Health England (2018): *Carbon Modelling Within Dentistry – Towards a Sustainable Future*. London: Public Health England

Sustainable Development Unit (2020): *Health Outcomes Travel Tool*. Sustainable Development Unit: Available online at: https://www.sduhealth.org.uk/delivery/measure/health-outcomes-travel-tool.aspx (Last accessed 08/03/2020)

Sustainable Development Unit (2016): *Carbon Footprint Update for NHS in England 2015*. Sustainable Development Unit: Available online at: https://www.sduhealth.org.uk/policy-strategy/reporting/nhs-carbon-footprint.aspx Last accessed 15/10/2018

UK Government (2008): *Climate Change Act 2008*. UK Government: London: HMTSO. Available at: http://www.legislation.gov.uk/ukpga/2008/27/contents. Last accessed 08/12/2019

United Nations (2018): *UN Climate Change Annual Report 2017*. United Nations Framework Convention on Climate Change (UNFCCC): Available at https://unfccc.int/resource/annualreport/media/UN-Climate-AR17.pdf Accessed 08/12/2019

Waste and Resource Action Programme (WRAP). (2016): *Plastics Market Situation Report Spring 2016*. WRAP: Banbury

Welsh Government (2020): *Population: Statistics on Numbers of People in Wales. StatsWales*. Available online at: https://statswales.gov.wales/Catalogue/Population-and-Migration/Population. Last accessed 10/03/2020

Welsh Government (2015): *Wellbeing of Future Generations (Wales) Act*. Available at: http://www.legislation.gov.uk/anaw/2015/2/enacted/data.pdf. Last accessed 08/12/2019

Welsh Government (2011): *NHS Wales Carbon footprint 2009*. Available online at: http://www.wales.nhs.uk/news/18489. Last accessed 16/10/2018

World Dental Federation (2017): *Sustainability in Dentistry*. Madrid: FDI World Dental Federation.

World Health Organisation (2018): *Climate Change and Health Factsheet*. World Health Organisation. Available online at: http://www.who.int/en/news-room/fact-sheets/detail/climate-change-and-health. Last accessed 15/10/2018