

How important is sustainability to the dental profession in Ireland?

Précis

A survey of 735 dental professionals (dentists, dental nurses, practice managers, hygienists, receptionists, specialists and other) found that 69% of respondents were interested in environmental sustainability.

Abstract

Objectives: To find out how important environmental sustainability is to the dental profession in Ireland. The extent of the dental profession's interest in and knowledge of sustainability is unclear.

Materials and methods: A total of 735 questionnaires were distributed to dental practices and at dental conferences in Co. Dublin. The questionnaires sought information from the members of the dental team on their interest in sustainability, their understanding of it, their interest in learning more, and whether they consider sustainable energy use, travel, waste disposal, goods and services, and costs. It also sought to find out if they measure their carbon footprint and if they think sustainability should be a HSE priority.

Results: A total of 735 questionnaires were distributed. A total of 69% of the respondents stated that they are interested in sustainability, and 68% think it should be a HSE priority. However, only 31% of dental professionals consider sustainable travel and 43% consider sustainable energy use, while 58% consider sustainable waste disposal practices. Over half of the sample said they fully understand what environmental sustainability means, with 64% of people interested in learning more about it. Of the respondents, 34% think sustainable practices would decrease costs, while 20% measure their practice's carbon footprint.

Conclusions: The dental profession in Ireland cares about environmental sustainability, but more research and policies should be introduced in Ireland to increase awareness of how sustainable practices can improve within dentistry.

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Introduction

Environmental sustainability is defined as "meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them".¹

Environmental sustainability is important. Climate change is a threat that is placing global health at risk. Human activity is said to be the main cause of this observed warming since the mid twentieth century.² The Environmental Protection Agency (EPA) compiles the greenhouse gas (GHG) emissions figures

for Ireland. The most recent emissions figures compiled in 2009 show that, in Ireland, agriculture is the single largest contributor to overall GHG emissions, at 29.2% of the national total, followed closely by energy and transport.³

Global energy demands are met by burning greater amounts of fossil fuels, which release GHGs into the atmosphere in amounts greater than can be neutralised by the natural ecosystems of Earth.² GHGs in the atmosphere act like a mirror and reflect part of the heat radiation back to the Earth. The higher the concentration of GHGs in the atmosphere, the more heat energy is being



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reflected back to the Earth.⁴ The effects of this are evident. Analysis of the meteorological records show that there was a trend in temperature rise in Ireland of 0.4°C during the period 1980–2008, the equivalent of 0.14°C per decade.³ An increase in global temperatures causes rises in sea levels and extreme weather conditions such as droughts and floods.⁵ Climate change is an issue that requires tackling and GHG emissions need to be reduced substantially to ensure a healthier environment for our future. By 2030, the EU expects Ireland to have reduced its carbon emissions by up to 30% compared to 2005 levels.⁶

In dentistry, while ‘environmental sustainability’ and ‘eco-friendly’ are known terms, ‘environmentally sustainable practice’ is a new concept. Although the impact of mercury in amalgam restorations has been a topical issue since the Minamata Bay disaster in the 1950s and 1960s, other aspects of dentistry contribute to the degradation of the environment, both directly and indirectly, and have been of less interest.^{7–9} One of the aims of the dental profession is to enhance quality of life and general well-being through oral

health; to do so while not considering the environmental effects of dental practice would be difficult to reconcile. It is essential to find out what efforts are made in the dental profession to promote sustainable practice.

In Ireland, the HSE has devised an action plan, The Sustainability Strategy for Health, to achieve a more sustainable health system and maintain a low carbon footprint. The HSE Sustainability Strategy for Health outlines 33 key actions under seven pillars of sustainability: (i) communications and engagement; (ii) energy efficiency; (iii) water conservation; (iv) waste prevention; (v) sustainable transport; (vi) green procurement; and, (vii) designing the built environment (Figure 1 above).¹⁰

In the UK, similar guidelines exist. The Sustainable Development Strategy for the Health, Public Health and Social Care System 2014–2020 focuses on eight key areas for implementing sustainability in healthcare: i) carbon hotspots; ii) commissioning and procurement; iii) sustainable clinical and care models; iv) healthy, sustainable and resilient communities; v) metrics; vi) innovation, technology and R&D; vii) creating social value; and, viii) leadership, engagement and development.¹¹

Despite these guidelines, there is limited research, particularly in Ireland, on the dental profession’s influence on climate change.

Public Health England analysed the carbon footprint of dental services in England from 2013–2014.¹² A carbon footprint is defined as: “The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO₂)”.⁵

This report found that the total GHG emissions of NHS dental services in England made up 3% of the overall carbon footprint of the NHS in England. Travel made up almost two-thirds of the total carbon footprint of dental services in England.¹²

In Scotland, Duane *et al.* (2012) combined a top-down approach, using input-output analysis for indirect carbon emissions (procurement), and a process analysis (bottom-up) approach for direct emissions (building energy, travel, waste and water). The authors found that travel was the greatest source of carbon emissions (45.1%), followed by procurement (35.9%) and building energy (18.3%). They concluded that Scotland’s NHS dental service annually generates 4% of the total Scottish NHS carbon footprint.¹³

In 2014 a further study was carried out in Scotland, which found that by halving patient travel, the carbon emissions of the Community Dental Service (CDS) could be reduced by 10.85%.¹⁴

In Ireland, the research is limited with regard to environmental sustainability in dentistry. It is important to discover the attitudes of dental professionals towards environmental sustainability so that the Irish dental profession can improve on its role in reducing carbon emissions and protecting the environment. The primary aim of this research project is to discover these attitudes, while also examining current sustainability strategies, their effectiveness, and how they can be improved to achieve the highest quality dental services in a sustainable fashion.

Materials and methods

The sampling was undertaken by fourth-year dental students from Trinity College Dublin. Data was collected by visiting dental practices in Co. Dublin, as well as attending dental conferences and branch meetings in Co. Dublin during the data collection period. The data collection period was from the end of September 2017 to the beginning of January 2018. This sampling method was carried out with the approval of the Dublin Dental University Hospital ethics committee. The dental practices in Co. Dublin were notified by email that a student would be visiting the practice to distribute questionnaires to members of the dental team. Participants were informed that fourth-year dental science students from Dublin Dental University Hospital were carrying out a research project to investigate the attitudes of the dental professionals of Ireland towards sustainability in the dental profession.

All members of the dental team (dentists, dental nurses, hygienists, practice managers, other) were invited to complete a questionnaire individually (Appendix 1). If the practice wished to be involved in the study, the practice manager or dental team (as appropriate) were given hard copies of the questionnaire. The practice had the opportunity to decline participation in our survey. The participants were asked to place their completed questionnaires in the collection box provided, which was then collected 30 minutes after distribution. If it was not possible for the dental professionals to complete the questionnaires at that time, an addressed envelope was supplied for return by post anonymously.

Attendees at conferences held in Co. Dublin and Irish Dental Association branch meetings were also targeted to participate. The chairpersons of the conferences and branch meetings were contacted via email to request permission to attend and distribute the questionnaire (Appendix 2). A collection box was used to collect the completed questionnaires to preserve anonymity. The collection box was left in the conference room and collected 30 minutes after the conference was over.

TABLE 1: Analysis of answers to the 10 questions in the questionnaire in percentages.

	Yes	No	Neutral
Dental professionals interested in sustainability	69%	12%	19%
Dental professionals who think sustainability should be a HSE priority	68%	9%	23%
Dental professionals who consider sustainable travel	31%	27%	42%
Dental professionals who consider sustainable energy use	43%	25%	32%
Dental professionals who consider sustainability when buying goods and services	37%	30%	33%
Dental professionals who consider sustainability when managing waste	58%	19%	23%
Dental professionals who fully understand sustainability	53%	20%	27%
Dental professionals who think sustainability would decrease costs	34%	33%	33%
Dental professionals who measure their practice's carbon footprint	20%	80%	
Dental professionals interested in further learning about sustainability	64%	36%	

The results were analysed using Chi-squared tests and a Fisher's exact test. Comparisons were made to understand the differences in dental professionals' responses between the following variables: (1) their interest in sustainability; (2) whether they think sustainability should be a HSE priority; (3) their consideration of sustainable travel; (4) their consideration of sustainable goods and services; (5) their sustainable waste disposal practices; (6) their understanding of sustainability; (7) their opinion on sustainability decreasing costs; (8) whether or not they measure their carbon footprint; and, (9) their interest in learning more about sustainability. These variables were also analysed with regard to whether the professionals' gender, role, area of work and year of graduation impacted their response.

Results

In total, 735 questionnaires were distributed and 333 responses were received, which was a 45% return rate. In the responses, 69% were females and 31% were males.

TABLE 4: Dental professionals' interest in sustainability (%)

Gender	Males	Females
	63	72
Location of work	Rural	Urban
	75	68
Sector	HSE	Private practice
	74	67
Role	Dentist	Nurse
	69	79
	Hygienist	Specialist
	55	57
	Manager	Other
	63	75

TABLE 2: Number and percentage of responses across the dental team.

Role	No. of responses	% of total responses
Dentist	118	36%
Nurse	87	26%
Hygienist	31	9%
Specialist	21	6%
Receptionist	64	19%
Manager	8	3%
other	4	1%

TABLE 3: The professionals' decade of graduation and their interest in sustainability.

Total number of dental professionals % of those interested in sustainability	Yes	No	Neutral	Total number of dental professionals who responded to questionnaire
Graduated in 1970s	100%	0%	0%	2
Graduated in 1980s	57%	32%	11%	28
Graduated in 1990s	64%	11%	25%	91
Graduated in 2000s	66%	12%	22%	117
Graduated in 2010s	83%	7%	10%	58

Table 1 shows the response to the ten questions. It can be concluded from this table that the majority of dental professionals (69%) in the study are interested in environmental sustainability and think it should be a HSE priority (68%). It can be deduced from the above table that 31% of dental professionals consider sustainable travel, and 43% consider sustainable energy use, while 58% consider sustainable waste disposal practices. In terms of the professionals' understanding of sustainability, over half of the sample said they fully understand what environmental sustainability means, with 64% interested in learning more about it. Only 34% of dental professionals thought sustainable practices would decrease costs. Of the professionals who responded, 20% stated that they measured their carbon footprint.

Table 2 shows the number of responses by team members. The greatest response was from dentists, at 36% of the total sample. This was followed by nurses at 26% and receptionists at 19%. Hygienists represented 9% of the sample, with the lowest responses being from specialists (6%), managers (3%) and other (1%).

Table 3 shows that the graduation year of the professional had an effect on their interest. There was a significant difference between those who graduated in the 70s or 80s and those who graduated after that (95% confidence interval: <0.05; Chi-squared value 7.3388; p=0.067). Out of those who graduated in the 1970s, 100% were interested in sustainability. The 1980s graduates were less interested in sustainability (57%). The 1990s and 2000s graduates had very similar levels of interest, with 64% and 66% being interested, respectively. The professionals who graduated in the current decade had a high level of interest in sustainability at 83%.

Of the males who answered the questionnaires, 63% were interested in sustainability and 72% of females were interested in sustainability (**Table 4**). This was not statistically significant (confidence interval 95%: <0.5; p=0.1327). The location of the dental practice had no effect on the dental professional's interest in sustainability. There was a very similar level of interest in

sustainability from people who work in rural areas (75%) and those who work in urban areas (68%). The sector the professional worked in (HSE or private) and the role of the dental professional also made no difference to their interest in sustainability.

Discussion

This study looked at dental professionals' opinions when it came to environmental sustainability. It can be extrapolated from the results that the dental profession in Ireland is interested in environmental sustainability, with 69% of the population in the study stating they were interested. There are 3,053 registered dentists in Ireland as of August 2017. The sample of 118 dentists is representative of the population at 3-4% of the total. There are 245 registered specialists in Ireland as of June 2018.¹⁵ A total of 21 specialists responded, which is also representative of the population. However, it is difficult to assess whether the number of dental nurses, receptionists and managers are representative of the population, as registration is not obligatory in these roles. Given that, on estimation, there are more dental nurses than dentists in Ireland, and there were fewer responses from dental nurses (87) than dentists (118) in this study, the sample is probably not representative in terms of dental nurses. There was no statistically significant difference in male and female interest, or between the different roles of the professionals, as mentioned previously in the results.

The age of the dental professional (which was assumed from the year of graduation) had an impact on their interest in environmental sustainability (Table 3). Graduates from the 1980s had less interest (57%) than those who graduated in the 2010s (83%). This is in contrast to previous studies, which display that there is little to no relationship between age, and attitudes and behaviours towards environmental sustainability.¹⁶

Another limitation of this study was that only 16% of the responses were from rural areas. This does not reflect the true population of Ireland, where the ratio of urban to rural population is approximately 2:1.¹⁷ If we apply this to the dental profession, the sample in the study needs to be considered more representative of people living in Dublin than the entire country. Another limitation of the study was that the dental professional had to self-identify as to whether they worked in an urban or rural practice. For example, a professional may work on the outskirts of a big city and consider themselves as working in a rural practice. This must be taken into consideration when analysing the results.

The opinion on whether practising sustainability would decrease costs had a varied response across the dental team. This could be due to the lack of clear evidence as to whether carrying out environmental sustainability practices decreases costs. Practitioners may also find it difficult to gauge the efficacy of long-term environmentally sustainable practices such as sourcing energy from renewable sources. However, the addition of low initial cost interventions such as the use of LED lightbulbs can have a large impact.

There is an increased awareness of safe waste disposal practices in the dental profession in Ireland. All clinical waste handling and disposal procedures in Ireland must comply with regulations: The Environmental Protection Act 1990 (including the Duty of Care Regulations); The Controlled Waste Regulations 2012; The Hazardous Waste Directive 2011; and, The Carriage of Dangerous Goods Regulations.¹⁸ In addition, EU waste policy has evolved over the last 30 years. The Waste Framework Directive introduced a five-step waste hierarchy recently where prevention is the best option, followed by re-use, recycling and

other forms of recovery, with disposal such as landfill as the last resort.¹⁹

There was an interesting response to the question of whether people consider sustainable waste disposal, with 53% of people saying that they do while only 31% consider sustainable travel (Table 1). While it is known that travel and transport form 13% of the health, public health and social care carbon footprint, and is the most significant factor in environmental sustainability, there was a general consensus from this study that waste disposal was more important.²⁰ Most people are familiar with the mantra 'reduce, re-use, recycle' and employ such sustainable measures at home, so the fact that they carry out similar waste disposal methods in their profession is not surprising.

There is perhaps a lack of awareness of the impact travel has on environmental sustainability as there are currently no regulations on sustainable travel in Ireland. McGain and Naylor (2014) looked at the extent to which hospital environmental sustainability had been studied, and suggested that an improvement in sustainable travel is dependent on three factors:

- technical changes: improvements in vehicle technology and altered health service infrastructure to reduce travel times and distances;
- financial incentives: promotion of active and public transport to increase the numbers of staff and patients who are using more environmentally sustainable methods of travelling to the practice, and de-incentivise personal car use; and,
- social and cultural factors: cultural and societal norms have a large influence on methods of transport used by the public – increased convenience of public transport has been shown to result in increased public transport use.²¹

While McGain and Naylor (2014) looked at healthcare services only, and dental practices are not located by centralised decision as hospitals are, the factors involved in sustainable travel still apply. Due to these multiple factors, members of the dental team may find it easier to enact sustainable waste and energy management. This could explain why significantly fewer members of the dental team consider sustainable travel, compared to sustainable waste and energy management.²¹

Employing simple changes like increasing sustainable travel to work by cycling, walking, carpooling or opting for public transport, switching over to vehicles that reduce fossil fuel usage or using a 3D scanner instead of shipping physical counterparts to a laboratory could all help to reduce travel-associated carbon emissions.²

Conclusion

This study illustrates that the dental profession in Ireland generally does care about environmental sustainability, and is interested in learning more about it. It is evident that a larger sample, particularly in the case of dental nurses, would have improved the study and its representation of the population. It is imperative that more research is carried out on this topic in Ireland to find out how the dental profession can put better measures in place to protect our planet.

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Appendix 1

Questionnaire distributed to dental professionals.

Dublin Dental Hospital is keen to gather views from the dental team about environmental sustainability. Please take a few moments to complete the survey questionnaire. Your responses will remain completely anonymous.

Please tick your choice:

Gender: Male ☐ Female ☐ Other ☐

Role: Dentist ☐ Specialist ☐ Dental nurse ☐
 Hygienist ☐ Receptionist ☐ Practice manager ☐ Other ☐

Work predominantly in: HSE ☐ Private ☐

Location: Urban ☐ Rural ☐ Year of graduation:

Please ☒ tick the most appropriate response to the following statements:

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I am interested in sustainability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sustainability should be a high priority in the HSE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our practice always considers sustainable travel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our practice always considers sustainable energy use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our practice always thinks about sustainability when buying goods and services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our practice always thinks about sustainability when it manages general waste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I fully understand what sustainability means in the context of my practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Making our practice sustainable would decrease costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our practice measures and monitors its carbon footprint		Yes <input type="checkbox"/>	No <input type="checkbox"/>		
I would be interested in learning more about sustainability in dentistry		Yes <input type="checkbox"/>	No <input type="checkbox"/>		

Would you be interested in participating in further research in sustainability? If yes, please email: Brett.Duane@dental.tcd.ie

Thank you for your participation.

Appendix 2

Conferences attended in the Republic of Ireland

- October 19, 2017: IDA Metro Branch Meeting – Alexandra Hotel, Dublin
- October 23, 2017: IDNA Scientific Lecture – Considerations for Diet and Oral Health in our communities: What have we learned? – Dublin Dental University Hospital
- November 28, 2017: RAMI odontology lecture – Prosthodontic Practice – New Technology Interfaces – Dublin Dental University Hospital