National Dermatological Surgery Sustainability Survey: An Evaluation of Healthcare Professional Beliefs and Practices

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What is already known about this topic?

- There is a global recognition of the need for environmental sustainability in healthcare.
- Dermatological surgery contributes to healthcare's environmental impact.

What does this study add?

- Reveals current sustainability practices among UK surgical dermatological healthcare professionals.
- Identifies that more local work is required to integrate reusable equipment, streamline single-use sets, single-wrapping, and turn off theatre room lighting/equipment/heating/air conditioning.
- Highlights the need for educational initiatives around climate change's impact on health.

Abstract

Background Dermatological surgery contributes to the large environmental impact of healthcare, but to date there are no data on the current sustainability practices, attitudes, or behaviours of UK and Republic of Ireland health professionals involved in skin surgery.

Objectives We sought to evaluate this using a national sustainability questionnaire, organised by the British Society for Dermatological Surgery.

Methods Over 12-weeks, a 17-item online questionnaire was distributed nationally to healthcare professionals involved in skin surgery.

Results 115 UK healthcare professionals responded. 'See and Treat' provision for non-Mohs skin surgery was described by 32% of respondents. When compared to single-use equipment (Median=4), reusable equipment (Median=7) outperformed on perceived safety (p =.0056), quality (p =.00001), and patient outcomes (p =.0067), but no difference was found in usability (p =.68916). Perceived sustainability was greater in the reusable (Median=7) than single-use (Median=1)(p=.00001). Almost all (97%) respondents believe global climate change is happening, and the majority (74%) are concerned by dermatological surgery's impact. However, only 44% feel comfortable discussing health effects of climate change with patients. Whilst 75% turn off surgical lighting in between lists, often room lighting (31%), equipment (32%) or heating/air conditioning (22%) is forgotten.

Conclusion Whilst awareness of the impact of dermatological surgery on global climate change is common among healthcare professionals involved in skin surgery, there is room for improvement in translating this into local action, advocacy, and service improvement to standards dictated by national sustainability guidance.

Introduction

Climate change poses a critical threat to public health.[1] Healthcare delivery has been estimated to account for 4-5% of global net carbon emissions,[2] with the National Health Service (NHS) being the largest greenhouse gas contributors in the UK.[3] The NHS has set ambitious targets: achieving net zero emissions for Scope 1 and Scope 2 Green House Gas Protocol (GHGP) emission by 2040, which cover direct emissions from its own operations and indirect emissions from purchased energy. Furthermore, the NHS aims to reach net zero for Scope 3 emissions (encompassing all other indirect emissions across its supply chain) by 2045.[3]

Driven by the recognition of the healthcare industry's substantial environmental impact and the resource intensive nature of dermatological surgery, further evaluation of current sustainability practices, attitudes, and behaviors of healthcare professionals involved in skin surgery is necessitated. Surgical fields, including dermatological surgery, presents environmental sustainability challenges through intensive utilisation of medical supplies, surgical equipment, and

energy-intensive technologies contributing to carbon footprint, waste generation, air pollution and associated procedural unintended negative environmental impacts.[4] However, transitioning to more sustainable alternatives can offer environmental benefits and cost savings.[5]

The British Society for Dermatological Surgery (BSDS) Sustainability Guidance 2022[4] encompasses a comprehensive approach and recommendations to minimise the ecological footprint of dermatological surgery and wider healthcare delivery. It considers optimising resource utilisation, reducing waste generation, conserving energy, and adopting practices that could potentially lower the ecological impact of skin surgery throughout the care continuum. Targeted implementation of recommended interventions requires initially addressing a notable gap in the literature concerning the baseline sustainability practices and perspectives of UK and Republic of Ireland dermatological surgeons. This study aims to address this gap by conducting a national sustainability questionnaire, coordinated by the BSDS, with the overarching goal of achieving system-wide commitment to promote environmentally conscious healthcare delivery.

Methods

Questionnaire design

A 17-item online questionnaire was created using Microsoft Forms and comprised dichotomous, multiple choice, free text, and Likert-type scale questions. The primary end point was to assess current skin surgery sustainability practices, opinions and beliefs of professionals working in skin surgery, including determining the extent that different professional groups adopt environmental practices. Key questions relating to attitudes have been adapted from a validated sustainability questionnaire distributed in the US.[6] The questionnaire used conditional branching to only display questions which are relevant to the respondent's experience. Questionnaire used is found in Appendix S1.

Ethics and validity testing

Ethical approval was granted for this survey by the King's College London College Research Ethics Committee (reference: MRM-21/22-26108). The questionnaire items and platform were pilot tested among a convenience sample of consultant dermatologists and trainees, validating its feasibility for use among healthcare professionals working in the field of skin surgery.

Distribution

Responses were collected over a 12-week period from 3rd October to 26th December 2022. This open survey was distributed nationally through several dermatology societies including the British Association of Dermatologists (BAD), the British Society for Dermatological Surgery (BSDS), the Scottish Dermatological Society (SDS), and the British Dermatological Nursing Group (BDNG). Dermatologists were also encouraged to share the survey link among their relevant contacts. To prevent duplicate survey submissions, the survey platform employed IP address tracking.

However, due to the survey's promotion across multiple professional societies, there remains a potential for duplication.

Analysis methods

Qualitative free-text data were cleaned, systematically categorised and quantified through content analysis using Microsoft Excel. Quantitative data were analysed using R-studio software for descriptive statistics, and IBM SPSS version 29.0 statistic software package for non-parametric testing of statistical significance where $p < .05$ was considered significant. Data visualisation was performed using packages dplyr and tidyverse in RStudio and the analytics feature embedded in Microsoft Forms.

Results

115 UK and Republic of Ireland healthcare professionals responded: 67 (58%) Consultant Dermatologists/Post CCT Mohs Fellows, 26 (23%) Dermatology trainees, 12 (10%) Specialty and Associate Specialist (SAS) Dermatologists, and 10 (9%) Nurse-Surgeons (Table S1). Of the 115 respondents, all closed type questions were answered by 100% of respondents. One open free text question was answered by 97% of the participants that the question was available to.

Sustainability Practices in Dermatological Surgery Services

Single Visit Provision for Skin Surgery

We investigated the number of in-person visits required for patients undergoing skin surgery (excluding Mohs micrographic surgery). The majority of respondents (77 out of 115, 67.0%) indicated patients required two in-person visits, including separate appointments for lesion review and surgery. Additionally, 37 respondents (32.2%) answered patients were able to undergo skin surgery in a single visit, which included 'See and Treat' services, one-stop clinics, and direct surgery booking after remote teledermatology review. Only one respondent (0.9%) indicated three or more in-person patient visits, involving separate appointments for lesion review, follow-up assessment, and surgery.

Single visit provision (e.g. ‘See and Treat’) for skin surgery was noted in 32% of overall respondents, where provision was notably higher among London respondents (67%) compared to other regions (24%) ($p<.001$). Other regions with high rates of reported single visit provision include Wales (60%), Northeast (57%) and West Midlands (38%).

Operational Resource Sustainability

Operational resource use related to use of single-use sets, double wrapping of surgical equipment, and a use of single-use and reusable equipment.

Overall, 47 respondents (41%) indicated using particular equipment in single-use sets less than half of the time during skin surgery, majority of which were from Scotland (21%) and London (19%). Equipment which was reported to be most unused included non-toothed forceps, artery clips, and skin hooks. Double wrapping of surgical equipment (plastic inner and outer packaging) was observed by 55 (48%) respondents, with an additional 17 (15%) being unsure.

Notably, 94 respondents (82%) indicated having experience working with both single-use and reusable equipment for skin surgery and were asked to rate the perceived attributes of each instrument type, including safety, quality, usability, environmental impact and patient outcomes (Figure S1). When compared to single-use equipment (Median=4), reusable equipment (Median=7) outperformed on aspects of perceived safety ($p = .0056$), quality ($p = .00001$), and patient outcomes ($p = .0067$). However, no statistically significant difference was found when comparing usability ($p = .69$). Perceived sustainability was greater in the reusable (Median=7) than single-use (Median=1) equipment ($p = .00001$) (Figure 1).

On the other hand, 21 respondents (18%) indicated having experience in using only one type of surgical equipment and, thus, were unable to compare the two. Among the 12 respondents who have only used single-use instruments (10%), most (≥ 50%) rated them highly in terms of perceived safety (Median=6), quality and efficacy (Median=5.5), usability (Median=6.5), and patient outcomes (Median=6). Nonetheless, perceived environmental sustainability of single-use instruments was evaluated as relatively low (Median=3). On the other hand, of the 9 respondents who have solely worked with reusable instruments (8%), the majority evaluated them highly across all five domains (Median=6) (Figure S2a).

Attitudes and Beliefs towards Sustainability in Dermatological Surgery

Awareness and Concern about Global Climate Change

There was a strong agreement in the responses overall and across different roles and regions of practice on questions concerning awareness of global climate change. Among 115 participants, 111 (96.5%) agreed that climate change is a topical global issue, 85 (73.9%) expressed concern about the environmental implications of dermatological surgery, and 86 (74.8%) indicated their belief that climate change has either already impacted or will impact their patients (Figure S2b). Nonetheless, a statistically significant difference was found in the agreement or disagreement on whether climate change has impacted or will impact their patients based on participants' roles ($p < .001$). While most consultants (69%) and trainees (79%) agreed, consultants showed more ambivalence, with 27% neither agreeing nor disagreeing (n = 18 of 67), compared to 8% of trainees (n = 3 of 38).

Measures to Reduce the Impact of Dermatological Surgery

The initiatives to discuss and mitigate the impact of dermatological surgery on global climate change were assessed among healthcare professionals. 73% (n=85) of respondents indicated having modified aspects of their personal and/ or professional life in response to climate change

and 85.2% (n=98) expressed agreement that dermatological surgery should take measures to reduce its environmental impact.

However, only 44% (n=51) indicated that they feel comfortable discussing the health effects of climate change with their patients (Figure S2b). There was a statistically significant difference between respondents' views on climate change and its impact on patients, and their comfort in discussing these issues with patients ($p < .001$).
In particular, dermatology trainees were significantly less comfortable discussing the health implications of climate change compared to nurse-surgeons, with 29% of trainees expressing discomfort versus none of the nurse-surgeons ($p = .038$). There were no significant differences between consultants and trainees ($p = .444$) or consultants and nurse-surgeons ($p = .077$).

There was no statistically significant difference observed in the mean rank values of the participants' reported level of concern regarding the impact of dermatological surgery on climate change and their adaptation of personal/ professional life as a consequence of the climate crisis ($p = .091$). Similarly, no significant difference was found in the mean ranks of the respondents' perceived impact of climate change on their patients and reported sustainable life modifications in response to climate change ($p = .187$).

Lighting and Energy Practices

Of the 115 respondents, 86 (74.8%) indicated the practice of turning off surgical lighting between surgery lists. Nonetheless, it was found that only 36 health professionals or their team members (31.3%) switch off room lighting, 37 (32.2%) ensure the equipment is offline, and 25 (21.7%) turn off heating/ air conditioning between lists (Figure S2c). There were no statistically significant differences observed between consultants, dermatology trainees, and nurse-surgeons in their lighting and energy practices.

Discussion

We report the first study to evaluate the sustainability practices, attitudes and beliefs of healthcare professionals working in skin surgery on a national scale in the UK and Ireland. The findings provide a useful insight into the current state of sustainability in dermatological surgery and highlight key areas for improvement.

We observed regional variation in the availability of single-visit provision for skin surgery ('See and Treat' services), which may inform targeted interventions to promote best practices. Specifically, London respondents reported a significantly greater proportion of single-visit provision relative to other regions, possibly due to the concentration of tertiary dermatology clinics, resources, and higher patient loads in London, necessitating streamlined service delivery. One-stop clinics significantly minimise requirement for follow-up visits, resulting in more financially

sustainable patient care and improved patient satisfaction.[8] Travel constitutes approximately 10% of the NHS carbon footprint so adoption of a one-stop approach to service provision is conducive to the delivery of a lean and environmentally sustainable dermatological surgery service.[2] A Republic of Ireland single-centre retrospective study found same-day surgery conferred a reduction of a 6.02 metric tonnes of CO2 for their 389 patient 'See and Treat' cohort, through decreased patient travel distance.[9] However, this study was based in an urban tertiary dermatology centre with referrals from both urban and rural areas, and emissions were calculated retrospectively assuming car travel. While the findings suggest environmental benefits, regional variability in service structures, patient demographics and referral patterns are likely. This warrants further prospective studies assessing the impact of 'See and Treat' models across different rural or urban areas in tertiary or secondary settings in the UK.

Medical equipment comprises 19% of the greenhouse gas (GHG) emissions of NHS England, dominating the supply chain emissions alongside pharmaceuticals and chemicals.[2] More than 40% of the respondents indicated using certain equipment in single-use sets less than half of the time during dermatological surgery. Revising the contents of single-use packs and eliminating infrequently used instruments has demonstrated financial and environmental benefits through waste reduction.[10] Revised single-use sets for skin surgery, reconsidering items such as non-toothed forceps, artery clips, and skin hooks will improve the sustainable value of dermatological surgery services. Moreover, double wrapping of surgical equipment was noted by nearly half of respondents in this study, and whilst often the main concern is contamination risk over single-wrapped items, several studies have refuted this.[5,11,12]

In keeping with Elkington's 'Triple Bottom Line' of aligning environmental, social and financial value, reusable equipment has demonstrated a better economic and environmental profile compared to their single-use counterparts.[13] To interrogate the key stakeholder's view of this possible paradigm shift, the survey explored perceived patient outcomes and social sustainability of single-use vs reusable equipment for skin surgery. Results showed perceived environmental sustainability of reusable instruments markedly surpassed that of single-use. Among the 82% of respondents who have experienced working with both single-use and reusable equipment, reusable equipment significantly outperformed across most domains including perceived safety, quality and efficacy, environmental sustainability and patient outcomes. This suggests an aligned shift to reusable equipment use in the provision of a sustainable skin surgery service, by virtue of its optimal value across each variable of the 'Triple Bottom Line'.[13] Indeed, centre-specific life-cycle assessments must be carried out comparing single-use and reusable equipment to confirm the presumed carbon footprint difference along the supply chain of a service.

We aimed to evaluate healthcare professional attitudes as a surrogate marker for behaviour and willingness to enact a culture change required to integrate sustainability in dermatological surgery. Most respondents agreed that climate change is an existing global threat, acknowledged its potential impact on patients, and indicated adapting elements of their personal and/or professional life accordingly. This suggests that health professionals who are conscious of the effects of climate change will likely have implemented sustainable life modifications. Nonetheless, it was found that almost a third of participating consultants expressed ambivalence regarding the existing or potential impact of climate change on their patients. This indicates a further need for increasing awareness among consultant dermatologists about the prospective health implications of GHGs on patients. While many expressed concern regarding the environmental implications of dermatological surgery and agreed that measures are required to reduce its impact, less than half felt confident discussing the health effects of climate change with patients; with notable discrepancy between dermatology trainees and nurse-surgeons expressing most discomfort.

Our findings demonstrate the need for a system-wide approach to improve sustainability practices. Climate change and its health impacts can be integrated into medical education and dermatology training curriculums to provide trainees with the knowledge and skills required to address climate change locally.[14] This will empower future generations of dermatologists to manage skin conditions exacerbated by climate change and cultivate a culture of environmentally conscious behaviours. Additionally, where feasible, introducing sustainability officers and designating local champions in hospitals can support the decarbonisation of health services.[4] Environmental researchers should consider the use of life cycle assessments as a secondary endpoint for clinical trials to guide environmentally sustainable practices.

Skin surgery is an energy-intensive practice.[15] An Australian study evaluating the carbon footprint of dermatological surgery through a life cycle assessment demonstrated that electricity is one of the largest contributors to an estimated annual emissions of 8641 tonnes of CO2 from dermatological surgery.[16] This survey examined lighting and energy practices of consultant dermatological surgeons, trainees and nurse surgeons. Although a substantial proportion of respondents reported turning off surgical lighting between surgery lists, less than a third of participants engaged in practices such as switching off room lighting, ensuring equipment is offline, and turning off heating or air conditioning. The absence of specific significant differences between consultants, trainees, and nurse-surgeons in these practices suggests that basic energy-saving and energy-wasting behaviours may be learned from generic staff training or stem from factors external to professional roles. There may be a discrepancy between awareness of global climate change and willingness to adjust practice, versus actual implementation of sustainable measures. An energy behavior change programme launched by Global Action Plan and Barts

Health NHS Trust, which motivated healthcare professionals across six sites to switch off unused equipment, turn off lights, and adjust temperatures,[17] yielded considerable financial savings and GHG reductions of approximately 2200tonnes of carbon dioxide per year.[18-20] There remains a need to further explore reasons for not engaging in energy saving practices and to promote switching off room lighting, electrosurgical equipment and air conditioning for all staff.[21] Implementation of these actions may be facilitated by the appointment of local environmental champions to educate and inspire staff to practice sustainable behaviour, and environmental restructuring interventions.[22]

There are limitations to this sustainability survey. The relatively low response rate may introduce selection bias and limit the generalisability of the findings. The overall response rate of the questionnaire is not specified due to survey distribution design and overlap of dermatological organisation membership; however, it can be estimated to be approximately 11-12%, extrapolating from number of dermatologists in NHS England (n= 659) compared to surveyed dermatologists in England (n=77).[7] Despite efforts to distribute the survey nationally through various reputable dermatology professional societies. certain regions (e.g. Republic of Ireland) and roles (e.g. nurse-surgeons) were underrepresented. Moreover, the study relied on self-reported data, which is subject to recall, response and social desirability biases. Future research could consider objective measurements or observational studies to validate and complement self-reported sustainability practices. Given that the study was completed in December 2022, it is possible that there may have been some change in sustainability attitudes or practices since conducting then. However, we think that the findings remain relevant and provide valuable insights into recent practices. Whilst there is an absence of recent studies indicating significant changes in sustainability attitudes or practices in dermatology, the results should be considered in the context of the evolving nature of sustainability and potential future advancements. Finally, the survey solely focused on the perspectives and practices of healthcare professionals, and further studies could explore patient perspectives and their role in promoting sustainability in dermatological surgery.

Conclusion

In conclusion, this national sustainability survey captures a unique overview of sustainability practices, attitudes, and beliefs of healthcare professionals involved in dermatological surgery in the UK and Ireland. Despite general recognition of the need for sustainability, greater efforts are required to translate current awareness into tangible sustainable actions and promote optimal practices across different regions which conform to the standards outlined by the national BSDS

Sustainability Guidance 2022.[4] The study highlights opportunities for the adoption of low carbon alternatives including reusable equipment, lean healthcare practices such as same-day surgery, and sustainable resource use through reduced single-use sets, single-wrapping of instruments and energy conservation measures in skin surgery. It also indicates the potential for the incorporation of climate change in training programmes, employment of local sustainability champions and promotion of life cycle analysis in research to facilitate decarbonisation in the field of dermatological surgery. It is crucial to address the heterogeneity and gaps identified in sustainability practices, and foster a system-wide commitment to environmentally conscious healthcare delivery while striving for high-quality patient care.

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Figure Legends

Figure 1. Stacked bar charts depicting respondents' evaluations of single-use and reusable surgical equipment in terms of their perceived environmental impact.

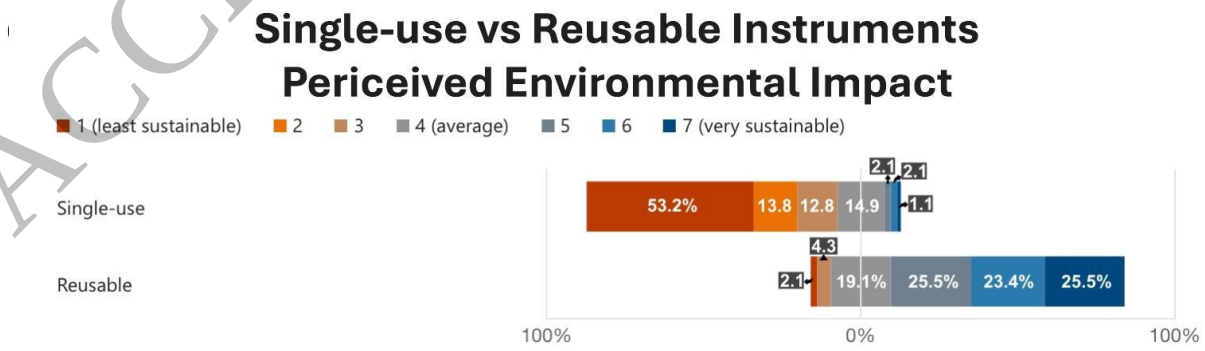

Figure 1
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