

# Environmental sustainability and gynaecological surgery: Which factors influence behaviour? An interview study

Kim E. van Nieuwenhuizen<sup>1</sup>  | Ingena G. I. A. Both<sup>1</sup> | Petra J. Porte<sup>2</sup> |  
Anne C. van der Eijk<sup>3,4</sup> | Frank Willem Jansen<sup>1,4</sup>

<sup>1</sup>Department of Gynaecology, Leiden University Medical Centre, Leiden, The Netherlands

<sup>2</sup>Department Health Services Management & Organisation, Erasmus School of Health Policy & Management, Erasmus University Rotterdam, Rotterdam, The Netherlands

<sup>3</sup>Operating Room Department and Central Sterile Supply Department, Leiden University Medical Centre, Leiden, The Netherlands

<sup>4</sup>Department of BioMechanical Engineering, Delft University of Technology, Delft, The Netherlands

## Correspondence

Frank Willem Jansen, Department of Gynaecology, Leiden University Medical Centre, Albinusdreef 2, Leiden 2333 ZA, The Netherlands.  
Email: [f.w.jansen@lumc.nl](mailto:f.w.jansen@lumc.nl)

## Abstract

**Objective:** To assess the various factors that influence environmentally sustainable behaviour in gynaecological surgery and examine the differences between gynaecologists and residents.

**Design:** An interview study.

**Setting:** Academic and non-academic hospitals in the Netherlands.

**Population:** Gynaecologists ( $n = 10$ ) and residents ( $n = 6$ ).

**Methods:** Thematic analysis of semi-structured interviews to determine the various factors that influence environmentally sustainable behaviour in gynaecological surgery and to examine the differences between gynaecologists and residents. By using the Desmond framework and the COM-B BCW, both organisational and individual factors related to behaviour were considered.

**Main outcome measures:** Factors that influence environmentally sustainable behaviour.

**Results:** Awareness is increasing but practical knowledge is insufficient. It is crucial to integrate education on the environmental impact of everyday decisions for residents and gynaecologists. Gynaecologists make their own choices but residents' autonomy is limited. There is the necessity to provide environmentally sustainable surgical equipment without compromising other standards. There is a need for a societal change that encourages safe and open communication about environmental sustainability. To transition to environmentally sustainable practices, leadership, time, collaboration with the industry and supportive regulatory changes are essential.

**Conclusion:** This study lays the groundwork for promoting more environmentally sustainable behaviour in gynaecological surgery. The key recommendations, addressing hospital regulations, leadership, policy revisions, collaboration with the industry, guideline development and education, offer practical steps towards a more sustainable healthcare system. Encouraging environmentally sustainable practices should be embraced to enhance the well-being of both our planet and our population, driving us closer to a more environmentally sustainable future in healthcare.

## KEYWORDS

behaviour, education, environmental sustainability, residents, surgery

## 1 | INTRODUCTION

Since the industrial revolution, human activities such as burning fossil fuels and deforestation have accelerated climate change, leading to a 30% increase in atmospheric

carbon and global warming, negatively impacting human health.<sup>1,2</sup> Despite medical professionals' responsibility for patient health, the healthcare sector contributes 4.4% of global greenhouse gas (GHG) emissions, raising ethical concerns.<sup>3</sup> Doctors, guided by the principle of 'do

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no harm', have a responsibility to reduce their carbon footprint.

Although the operating room (OR) occupies just 6% of a hospital's total square footage, surgeries significantly impact the environment through use of energy, anaesthetic gases and medical equipment.<sup>4</sup> The OR consumes three to six times more energy than the rest of the hospital, generating 20–30% of its waste, largely from disposable usage.<sup>5,6</sup> Technological innovations such as robot-assisted and minimally invasive surgery (MIS) have increased waste production, leading to an increase in the environmental impact of surgery.<sup>7</sup>

Gynaecological MIS relies heavily on disposable items, despite their negative environmental impact.<sup>8</sup> As the environmental impact can be reduced by decreasing the usage of disposable items, MIS presents a promising area for improvement. In MIS, different instruments have been developed to ligate structures and maintain adequate haemostasis. Initially, conventional techniques with a reusable scissor, diathermy and sutures were used. However, nowadays (mainly disposable) instruments with coagulation techniques, such as monopolar coagulation, bipolar coagulation and ultrasonic instruments are more commonly employed. Disposable coagulation instruments show advantages in laparoscopic and vaginal hysterectomy, reducing operating time and blood loss.<sup>9,10</sup> Nevertheless, in daily practice they are also used for other more simple procedures, such as tubectomy, resulting in a significant environmental impact. This is particularly true for vessel sealers.<sup>11</sup> Understanding factors influencing instrument choice and sustainability considerations is crucial to promoting environmentally sustainable behaviour.

The role of gynaecologists in educating residents who are in training to become gynaecologists is also significant. The medical curriculum is increasingly incorporating environmental sustainability.<sup>12</sup> Furthermore, millennials, the upcoming generation of gynaecologists, are displaying a heightened interest in environmental sustainability.<sup>13</sup> However, waiting for students to incorporate sustainability is not viable; change needs to happen now. Both gynaecologists and residents must drive this transformation, especially as residents learn surgical procedures from gynaecologists in the OR.

The aim of this study is to gain insight into various factors that influence environmentally sustainable behaviour in gynaecological surgery, identifying areas for improvement. Secondly, this study examines the differences between gynaecologists and residents, providing insights into residents' perspectives and education, representing the future of the profession.

## 2 | METHODS

### 2.1 | Study design, respondents and setting

To determine the factors that influence environmentally sustainable behaviour in gynaecological surgery, this study used a thematic analysis of semi-structured interviews. Both gynaecologists and residents with experience in benign gynaecological surgical procedures were included. Residents were

considered to have this experience when they were in the last 2 years of their 6-year residency and were doing a sub-specialty in benign gynaecological surgery. Residents have been included in this study due to their role as the gynaecologists of the future. Environmentally sustainable behaviour should be integrated at an early stage, and education, from gynaecologists to residents, may play an important role here. By involving both residents and gynaecologists, we aim to identify factors that contribute to this.

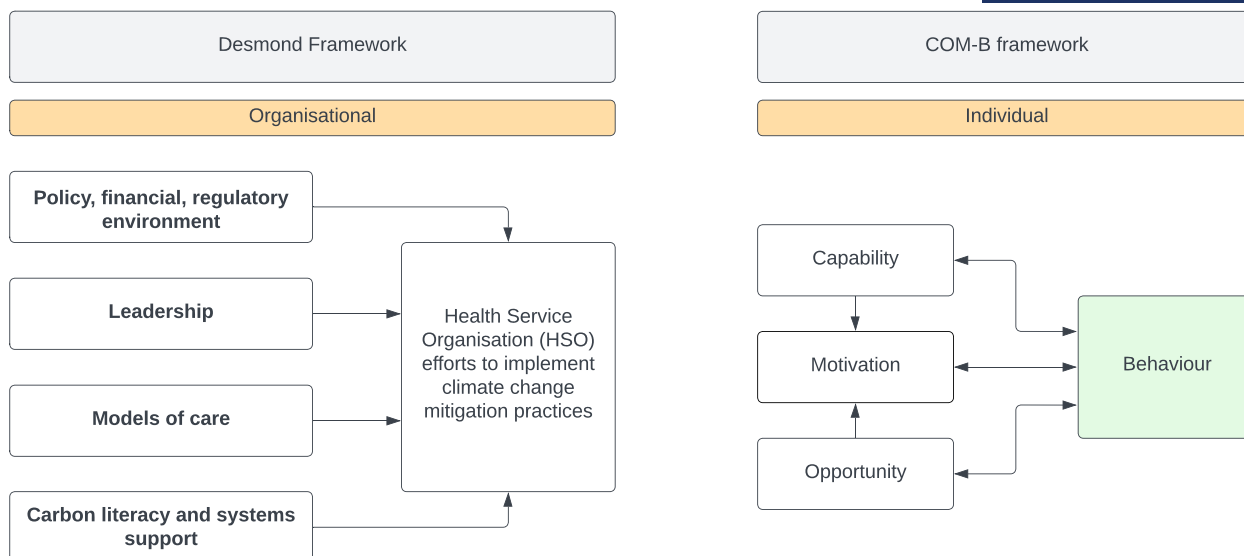
Semi-structured interviews were conducted between February and July 2022. Respondents were non-randomly selected from academic and non-academic hospitals in the Netherlands, using purposive sampling and snowballing. To avoid sample bias, both engaged and non-engaged respondents were actively approached. Qualitative research literature suggests that 70% of all identified themes emerge within the first six interviews, and 92% within 12 interviews.<sup>14</sup> Recruitment continued until theoretical saturation was achieved, ensuring a sufficient sample size for drawing meaningful conclusions.<sup>15</sup>

### 2.2 | Data instrument and collection, theoretical framework

All interviews were conducted using real-time video calling. Internal validity of the interviews was enhanced by having the interviews performed by a single researcher (IB). The interview guide included questions related to different types of instruments used in MIS to assess whether environmental sustainability considerations are considered in the choice of instruments. Other questions were based on the conceptual framework of Desmond and the COM-B Behaviour Change Wheel (BCW) (Figure 1).<sup>16,17</sup> For further details regarding the interview guide, please refer to [Supporting Information](#). Desmond developed a conceptual framework aimed at integrating sustainability into healthcare and highlights which contextual factors to include. They show that implementing sustainability efforts by Health Service Organisations (HSOs) is influenced by: (1) policy, financial and regulatory environment; (2) leadership; (3) models of care; (4) carbon literacy and systems support. This model was chosen to address how these organisational factors influence environmentally sustainable behaviour. The utilisation of the COM-B BCW provides a valuable approach for examining and recognising which factors influence behaviour on an individual level. The factors in this framework are: capability, opportunity, motivation and behaviour. This model has been successfully applied to various behaviour types, from patient groups to professionals.<sup>18,19</sup> By utilising both frameworks, the analysis process could be effectively guided, ensuring a comprehensive coverage of relevant factors in behavioural change.

### 2.3 | Data analysis

After conducting the interviews, the recordings were transcribed verbatim. Following the initial transcription of the



**FIGURE 1** Organisational and individual levels according to the Desmond and COM-B BCW framework.<sup>16,17</sup>

interviews, two independent researchers (IB and KN) read through the interviews, familiarised themselves with the data, and generated the initial codes. The coding was done thematically using topics from the interviews; in addition, new codes were developed following the responses of the respondents. This resulted in both an inductive and deductive approach. Software was used (ATLAS.TI version 9.1.3 [2089]) to code computer-assisted qualitative data analysis. Once the two researchers established an agreement, the subsequent step was initiated, and final themes were divided into the domain summaries from the COM-B BCW.

### 3 | RESULTS

In total, 16 semi-structured interviews were conducted, comprising a representative sample of Dutch gynaecologists ( $n = 10$ ) and residents ( $n = 6$ ) (Table 1). The data are presented according to the COM-B BCW structure, which elucidates the capabilities, opportunities and motivations related to behaviour. Capability encompasses an individual's psychological (e.g. knowledge, thoughts) and physical ability (e.g. skills) to engage in a specific activity. Opportunity involves external factors enabling behaviour, with physical opportunity being influenced by the environment and social opportunity by cultural influences. Motivation involves brain processes that drive behaviour, where reflective processes involve evaluations and plans, and automatic processes emotions and impulses.

#### 3.1 | Psychological capability

##### 3.1.1 | Awareness and carbon literacy

The 'Gynae Goes Green' national working group has contributed to growing awareness and carbon literacy among

**TABLE 1** Characteristics of the respondents.

Characteristics	Gynaecologist ( $n = 10$ )	Registrar ( $n = 6$ )
Sex		
Male	2	1
Female	8	5
Hospital		
Academic	3	1
Non-academic	7	5
Green Team and/or sustainability working group member		
Yes	5	2
No	5	4
Years of experience as gynaecologist (without registrar period) or as registrar (mean years, range)	16.9 (10–29)	5.5 (5–6)

respondents. They find value in the platform's email communication, sustainability lectures, and scientific articles. However, respondents note a disconnect between personal awareness and hospital practices, due to the primary focus on patient care. Despite motivation for change, respondents express frustration with slow progress, which may be attributed to a lack of carbon literacy within the hospital setting, particularly among those not involved in sustainability initiatives.

Residents emphasise the importance of gynaecologists' awareness and integration into teaching sustainable choices. Conversely, some gynaecologists mention that they already promote this. To enhance awareness, respondents suggest increasing visibility of OR waste and more efficient utilisation of medical products while providing information on their environmental impact. Collaboration with knowledgeable individuals could drive meaningful shifts towards sustainability.

*The doctor does not necessarily know, but he is well-intentioned, so I very much believe in cooperation.*

Resident (P3)

### 3.1.2 | Empowering individuals with responsibility

Many respondents demonstrate a positive attitude towards sustainable initiatives and recognise opportunities for change. They critically assess the necessity of products and avoid using unnecessary ones. Witnessing others making unsustainable choices is something they find unsettling. In contrast, some gynaecologists and residents express a reluctance to take on responsibility, or experience resistance from colleagues. They state that they are dependent on others and to the importance of adhering to established norms. By encouraging colleagues to collaborate and hold them accountable, a significant shift towards more environmentally sustainable behaviour can be fostered.

*It's not that we as gynaecologists say, 'this is how we're going to do it', but working together and making others accountable, involves asking for their input. I believe that's very important for driving change in a surgical group.*

Gynaecologist (P9)

## 3.2 | Physical capability

### 3.2.1 | Autonomy

Gynaecologists possess considerable autonomy and can drive sustainability initiatives within their own practices. However, to select their preferred surgical instruments, it is essential to work closely with other surgical medical specialists and aim for agreement on the instruments they jointly acquire in the hospital. The gynaecologist's skills influence their preferences. They prioritise convenience and comfort when choosing an instrument, opting for the faster and easier option, whether consciously or unconsciously, over sustainability concerns.

*One gynaecologist in particular, when he is on call he'll opt for a disposable vessel sealer because using reusables is more difficult, so choosing a disposable or reusable instrument is extremely reliant on the gynaecologists' experience.*

Gynaecologist (P3)

Conversely, some respondents advocate for greater flexibility in using fewer and more environmentally friendly

materials during surgery. The comparison is made with working in low-income countries, where expensive disposable instruments are not available, and the same surgeries are being performed with other techniques and (reusable) instruments. The residents suggest gynaecologists should be able to adapt to using more sustainable techniques.

### 3.2.2 | Leadership and time

Both gynaecologists and residents recognise the responsibility to incorporate environmental sustainability into their daily practices; however, time restraints pose a significant barrier. The high workload, coupled with the absence of dedicated time, hinders information gathering, establishing collaborations and integrating sustainability measures. Direct patient care and other responsibilities often take precedence, overshadowing the perceived importance of sustainability efforts. Leadership from an individual with both expertise and the availability of time is required. Gynaecologists find it challenging to assume leadership roles due to their numerous responsibilities, while residents acknowledge the feasibility of smaller tasks but highlight the impracticality of larger projects due to time consumption.

*I actually think that the subject deserves a much more thorough approach from individuals who have expertise or have already done it elsewhere in another hospital, taking the lead in this. It's a pity that there's not enough time for it.*

Gynaecologist (P7)

## 3.3 | Physical opportunity

### 3.3.1 | Visibility and availability

Some respondents were aware of hospital waste but came to fully understand its significance through presentations highlighting its consequences. Increased visibility not only enhanced knowledge and awareness, but also motivated them to change.

*I still have the *image* on my retina of the woman with breast cancer on the floor with all the material around her that was used for just one surgery. Shocking, I had no idea.*

Gynaecologist (P9)

When selecting surgical instruments, respondents prioritise environmentally sustainable alternatives that are user-friendly, cost-effective and of comparable quality. Regarding instruments to ligate structures, they mention that a disposable vessel sealer often is the preferred choice, despite it being expensive. Ease of use outweighs



both costs and sustainability, thus there is a demand for instruments with a low environmental impact that ensures equivalent quality, ease of use and, ideally, low or comparable costs. Another example is that they prefer disposable specula over reusables due to ease of use and patient comfort, despite their higher environmental impact. Redesigning medical instruments and devices could offer a potential solution.

*I also think that if you modify that metal version, it could potentially become a more comfortable speculum that can be reused again.*

Resident (P2)

### 3.4 | Social opportunity

#### 3.4.1 | Social environment and education

Responses to environmentally sustainable initiatives in the hospital vary. While support is increasing and a cultural shift is happening, some individuals lack knowledge on effective implementation. Additionally, residents encounter resistance in the form of negative remarks from colleagues when proposing sustainable initiatives.

*[...] but then I would sometimes receive remarks from certain gynaecologists who would say, 'Well, there she goes with her sustainability', as if they thought I was being overly dramatic.*

Resident (P6)

Thereby, they find themselves reliant on the choices made by the gynaecologist. If a gynaecologist prefers a specific instrument, the residents are expected to use it, creating a barrier to making more sustainable choices. Conversely, some gynaecologists stress the importance of providing teaching moments for residents, educating them about various surgical methods to promote sustainability. They find discussing sustainability easier with residents than with other gynaecologists, suggesting a generation gap. This is further highlighted by residents expressing that the new generation is intrinsically more motivated regarding sustainability and the climate. However, there is no consensus among training regions on which methods should be taught, and this decision depends entirely on the employing hospital.

#### 3.4.2 | Collaboration and regulations

Respondents mentioned 'Green Teams' within their hospitals, but their activities were often unclear due to insufficient communication. They also mention a lack of awareness about initiatives by other medical specialist groups, which requires collaboration. Some receive support from hospital boards and

committees, whereas others do not. Additionally, gynaecologists and residents report substantial support from the 'Gynae Goes Green' working group and the Dutch 'National Network the Green OR'.<sup>20</sup>

Respondents mention regulations related to instrument development hinder sustainability due to time-consuming and costly testing requirements. This presents a major challenge for the industry in adopting sustainable practices. Regulations should encourage and require environmentally sustainable medical products. The respondents rely on industry collaboration, but time constraints limit their efforts.

*So, involving the industry is important. It's not something that individual gynaecologists are likely to do because they simply don't have the time, you know? This is something that policy-makers and those who are involved in this field should address.*

Gynaecologist (P2)

Additionally, respondents find it easier to convince hospital management when costs are reduced. They recommend regulations that encourage sustainable behaviour, such as compensating train travel over flying for attending conferences. Regulations can facilitate sustainable practices, also in the OR. However, they also acknowledge changes should be made without waiting for specific regulations, enabling a faster transition.

### 3.5 | Automatic motivation

#### 3.5.1 | Habituation

Habituation contributes to environmentally unsustainable behaviour. Gynaecologists have become accustomed to specific instruments, leading to resistance to change. Residents, on the other hand, follow established practices from their training but are open to change if they receive environmentally focused training and opportunities for different techniques. They also believe that eliminating less sustainable options would be a solution, establishing a 'new standard' for everyone to follow.

*In that sense, we are still highly malleable, and it depends on how we are taught, especially if we don't know any better.*

Resident (P3)

### 3.6 | Reflective motivation

#### 3.6.1 | Surgical motivations

Gynaecologists and residents consider various factors when selecting instruments for surgeries, beyond sustainability.

Factors such as the reduction of complications, OR time, skill improvement, patient characteristics and surgery type are crucial. In complex and lengthy procedures, the less sustainable choice, such as a disposable vessel sealer, may be preferred. However, for a tubectomy, conventional bipolar scissors and forceps are commonly used. Patient safety is an important matter for respondents, surpassing sustainability. However, they acknowledge unnecessary fears of infection and propose adopting an evidence-based approach to assess disposable necessity, avoiding excessive measures in certain cases.

*The funny thing is that in national guidelines, we place great importance on practising evidence-based medicine, whereas in these types of protocols, there is very little evidence in favour of using disposable items.*

Resident (P3)

Finally, the majority of respondents aim for a sustainable transition, driven by concern for future generations.

### 3.7 | Behaviour interventions

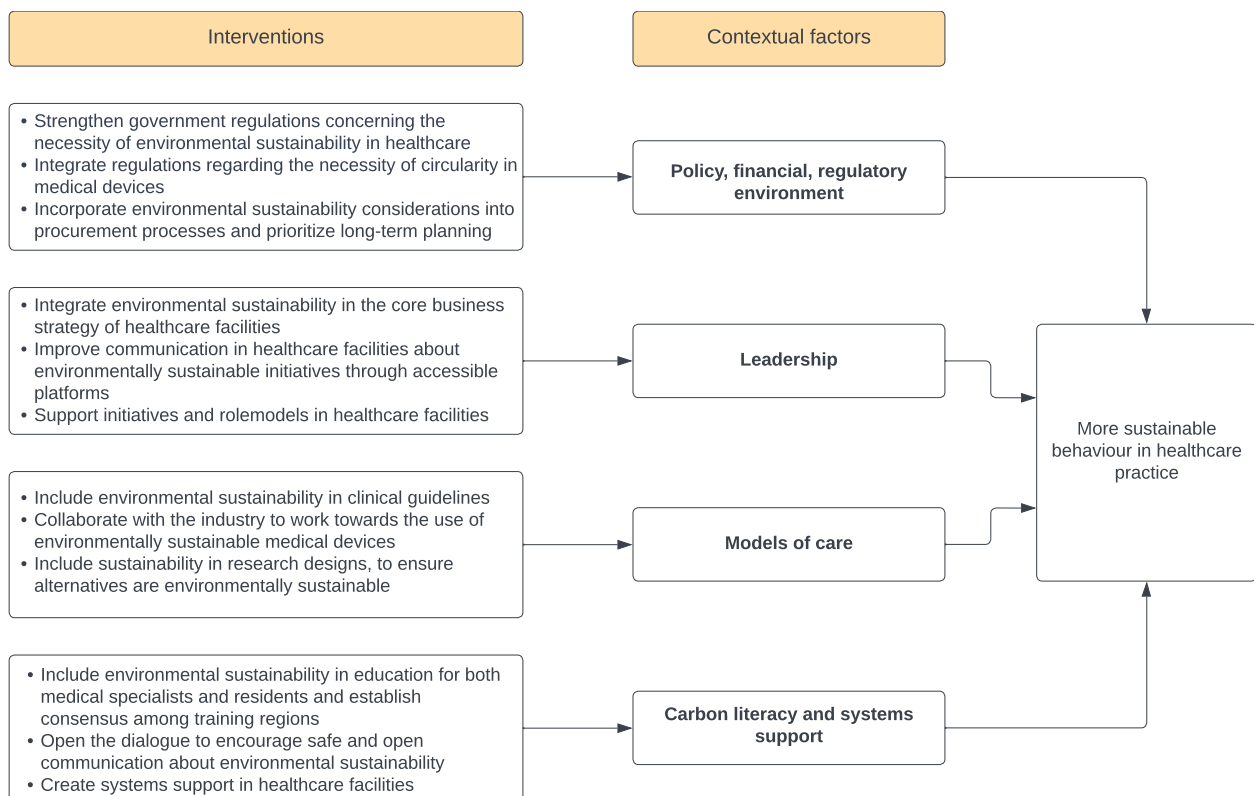
To achieve meaningful behavioural change, the COM-B BCW highlights the importance of combining capability, opportunity and motivation.<sup>17</sup> By utilising the Desmond

framework, we consider the organisational aspects of the healthcare environment.<sup>16</sup> Despite motivation for sustainability, barriers within existing systems hinder practice changes. Interventions based on COM-B BCW results from interviews have been proposed and integrated into a modified Desmond framework (Figure 2).

## 4 | DISCUSSION

### 4.1 | Main findings

Our study shows factors influencing environmentally sustainable behaviour in gynaecological surgery. Although awareness is increasing, knowledge of sustainable practices remains inadequate, leading to unsustainable behaviour. It is crucial to integrate education on the environmental impact of everyday choices into the training of both residents and gynaecologists and establish consensus among training regions. Autonomy allows gynaecologists to make their own choices; however, the availability of sustainable medical devices is necessary without compromising quality. Residents' autonomy is limited, and they are reliant on the gynaecologists' choices. This means the gynaecologist influences sustainable behaviour of both the resident and themselves. There is a cultural shift happening, but there is a need for a broader societal change that encourages safe and open communication about environmental sustainability,



**FIGURE 2** Expanded framework for sustainable implementations with potential interventions based on behaviour sources extracted from interviews, based on Desmond.<sup>16</sup>

as negative remarks are still being made. Additionally, to transition to more sustainable practices, leadership, adequate time, collaboration with the industry and supportive regulatory changes are essential.

## 4.2 | Strengths and limitations

This study included both gynaecologists and residents, examining the interaction between these two groups provides valuable insights into promoting sustainable behaviour. The respondents were selectively approached, ensuring representation beyond those solely involved in sustainability practices. A random sample approach could have offered additional insights, although data saturation was reached within this sample of respondents. In contrast to survey-based research focusing on attitudes and behaviour, this study's interviews enabled a deeper exploration of factors, providing a more comprehensive understanding of the interactions and diverse perspectives on environmentally sustainable behaviour.<sup>21–25</sup>

## 4.3 | Interpretation

By utilising the Desmond framework, we combine individual factors with contextual healthcare factors, providing insights into how to promote environmentally sustainable behaviour.

The framework identifies the policy, financial and regulatory environment as contextual factors influencing sustainability in healthcare. A survey of UK and Irish surgeons showed that 91% welcomed more guidance from national bodies on sustainability integration, and 87% desired increased monitoring and regulation.<sup>21</sup> A survey on American anaesthesiologists revealed limited commitment of hospitals to sustainable initiatives.<sup>26</sup> Our respondents advocate for increased government regulations to promote sustainability in hospitals, particularly monitoring eco-friendly practices. This approach ensures that doctors who do not embrace sustainable practices are also held accountable. Additionally, our respondents recommend regulations that promote circularity, encouraging reuse and redesign of medical devices, favouring sustainable alternatives. Policymakers should revise the Medical Device Regulation (MDR) to support and incentivise environmentally responsible practices.<sup>27</sup> This approach would facilitate the use of environmentally sustainable medical devices. Furthermore, the public healthcare system should prioritise long-term planning in accordance with NHS findings.<sup>28</sup> In this way, hospitals can benefit from lower long-term costs, a strategy that can positively impact the making of more sustainable choices. According to respondents, disposables may seem cheaper initially, but they can actually become costlier than reusables in the long run. Therefore, integrating long-term planning and sustainability criteria into tender and procurement processes is vital and will prevent financial incentives from overshadowing ecological responsibility. By aligning regulations with

environmental goals, hospitals can lead in fostering a sustainable and responsible healthcare system.

Insufficient leadership poses a significant obstacle to the implementation of sustainable practices.<sup>21</sup> The Green Deal 3.0 is an agreement between the Dutch government and its partners to reduce the environmental impact of healthcare.<sup>29</sup> However, according to our respondents, the exact impact of this initiative in hospitals remains unclear. To address this issue, hospital boards and employees working on this Green Deal must improve communication through accessible platforms. Despite the Green Deal agreement, respondents highlight the lack of support from managers and boards. Currently, sustainability efforts rely on passionate individuals, but time constraints hinder progress. To address this, healthcare facilities must integrate sustainability into the core business strategy. Respondents emphasise the need for a dedicated individual with expertise to champion eco-friendly practices throughout the organisation. Prioritising sustainable leadership and establishing a clear strategy can pave the way towards a more sustainable future for hospitals.

The 'models of care' factor emphasises evidence-based care pathways and best practices, but environmental sustainability is not consistently integrated into clinical protocols. The Royal Dutch Medical Association's code of conduct urges doctors to prioritise a sustainable healthcare sector and a healthy living environment.<sup>30</sup> This requires integrating sustainability into daily practice by guidelines. Yet, residents often adopt gynaecologists' practices without adhering to protocols. Gynaecologists must effectively impart this knowledge for better understanding and implementation. Furthermore, the use of disposables in the OR leads to a greater environmental impact, yet there is insufficient evidence to prove its superiority over reusables. As mentioned by the respondents, collaboration with the industry is essential to convey the necessity for sustainable medical devices and to increase their availability. The promotion of sustainability within established guidelines is pivotal for achieving long-term environmental and health advantages.

Our research shows an increased awareness of environmental sustainability, but practices still require improvement. Bridging the knowledge gap requires better workplace education.<sup>21,31</sup> To address this, doctors should receive comprehensive education on the environmental impact of their practices, emphasising ways to reduce this. Our findings show the importance of educating gynaecologists, as they play a crucial role in guiding residents. Currently, sustainability efforts focus on interns and students, neglecting post-graduate medical education.<sup>12,32</sup> Rectifying this involves equipping gynaecologists and residents with sustainability knowledge and training. Consequently, there is an immediate need for a societal shift that encourages open and safe discussions about sustainability. This involves promoting a culture of collaboration, where various factors that impact sustainable decisions in the OR are collectively addressed. As mentioned before, it is vital to educate both gynaecologists and residents, as the gynaecologists influence the habits and practices of residents. This education should encompass

lectures, courses and congresses at hospital and national levels, aligning regionally or preferably on a national scale. Increasing education on sustainability will eventually lead to more sustainable behaviour. Hospitals must acknowledge the necessity of supportive systems to encourage doctors in adopting sustainable practices. Empowering employees and teams with responsibility enables them to experiment and establish ideal conditions that facilitate learning, ultimately resulting in the successful adoption of sustainable practices and environmentally sustainable behaviour.<sup>33</sup>

## 5 | CONCLUSION

### 5.1 | Recommendations

The findings of this study can serve as a foundation to work towards more environmentally sustainable behaviour in gynaecological surgery. We have formulated four key recommendations:

1. The hospital board must ensure hospital regulations align with environmental goals, and transparently communicate about sustainability efforts through an accessible platform. They should foster sustainable leadership by integrating sustainability into the core business strategy and empowering dedicated individuals.
2. Policy makers should revise regulations to promote circularity in medical devices, encouraging the reuse and redesign of these devices. Healthcare professionals should collaborate with the industry to convey the necessity and enhance the availability of environmentally sustainable medical devices.
3. Guideline developers should incorporate environmental sustainability into guidelines, ensuring that doctors can easily integrate sustainable practices into their daily routines.
4. Educators should include education and training on planetary health and environmentally sustainable practices for gynaecologists and residents, facilitating adoption of sustainable behaviour in healthcare. Initiating a dialogue is essential to promote a safe and transparent discussion regarding sustainability within the OR.

Promoting environmentally sustainable behaviour should be broadly encouraged and established as a standard practice, to advance towards a more sustainable healthcare system and enhance the well-being of both our planet and our population.

### AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: KvN, IB, PP, FWJ; data collection: IB; analysis and interpretation of results: KvN, IB; drafting the paper: KvN, IB, PP, AvdE, FWJ. All authors reviewed the results and approved the final version of the paper.

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### CONFLICT OF INTEREST STATEMENT

None declared.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### ETHICS APPROVAL

Approaching of respondents was done by email and verbal consent was given at the start of the interview. The study has been approved for exemption from review by the Medical Ethics Review Committee (reference number 23-3047).

### ORCID

Kim E. van Nieuwenhuizen  <https://orcid.org/0000-0001-8531-4778>

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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