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# Knowledge of Surgeons and Practical Attitudes of Health Institutions in The Ile-De-France Region Towards Sustainable Development

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**Keywords**:

Sustainable development; Operating room; Surgeon; Healthcare institution, France

## 1. Abstract

**1.1. Introduction:** Surgical activities increase the emission of $CO_2$ and anesthetic gases into the environment. The objective of this study was to assess the level of knowledge of surgeons and the practical attitudes of institutions towards sustainable development.

**1.2. Methods:** This was a cross-sectional study. Surgeons were asked to participate in this study via a self-administered online questionnaire.

**1.3. Results:** The average age was 46.79±11.18 years, and 68(52%) were men, 48.9% of the participants had a low level of knowledge, 43.5% a medium level, and 7.6% a high level. The sustainable development charter is only available in 23% of the establishments in which respondents work, and specific actions in sustainable development are carried out in only 27% of establishments.

**1.4. Conclusion:** The level of knowledge of surgeons in Ile-de-France on sustainable development is insufficient. Regarding good practices for the reduction of the impact of the activity of the operating theater on the environment.

## 2. Introduction

By striving to improve the health of the population and individuals, the health system contributes significantly to climate change, which ultimately negatively affects human well-being [1]. Climate change represents one of the greatest threats to health in the 21st century [2,3]. Health facilities are a major source of pollution worldwide and contribute to environmental change [4]. Surgery is a resource-intensive sub-sector of healthcare, which means that this activity consumes considerable amounts of energy and consumables and generates large volumes of waste [5] The operating room uses 3 to 6 times more energy per square meter than any other service [5] and also contributes disproportionately to the total hospital waste [6] Much of the waste is wrongly disposed of as hazardous waste resulting in sub-optimal recycling and up to 20 times higher costs to treat and dispose of the waste appropriately [7,8]. This misclassification is partly due to the misunderstanding of the operator of the sorting system. In 2014, the release of anesthetic gases hydrofluorocarbons and chlorofluorocarbons was equivalent to 3 million tons of CO2, surgical interventions use a staggering number of single-use devices [9,10]. Currently only a handful of reusable devices are used in different surgical practices [1]. Plastic is the centerpiece of single-use devices and containers and, as a result, microplastics have become ubiquitous in the environment [11]. In 2012, the Institute of Medicine suggested that the health sector should lead by example in reducing its ecological footprint to improve global health and the health of the planet. Anesthetists have considerable freedom in developing care plans for patients and it is important to make choices that minimize the environmental impact of anesthetics without affecting the quality of patient care [1]. At present, health systems face multiple challenges to meet health care needs, and Sustainable Development does not seem to be a priority for surgeons. In addition to that, the humanitarian aspect of health care means that health professionals, especially surgeons, are not sufficiently engaged due to the lack of awareness of the impact of health care on the environment, considering the benefit-risk ratio too high to get involved in such actions. A study conducted on the knowledge of the Sustainable Development Goals (SDGs) among health workers reported that only forty-eight percent "48%" of respondents had a good knowledge of the SDGs [12] Another study reported that more than half of

healthcare professionals (54.4%) had no information about the Go Green Hospital initiative [13]. In 2004, the Joint Learning Initiative – a consortium of more than 100 health leaders – warned in its analysis of the global workforce that: "The only way to achieve the health SDGs is through the health worker: there are no shortcuts" [14]. Their commitment to creating healthier and more productive nations is the most cost-effective and rational way to achieve the SDGs [15]. There is a growing interest in "sustainable development" in operating rooms in the literature and how it can help reduce the carbon footprint of healthcare, but surgeons' modest level of knowledge could be a barrier to reducing the impact of the surgical activity on the environment. The objective of this study was to assess the level of knowledge of surgeons and the practices of healthcare institutions in terms of sustainable development.

## 3. Materials and Methods

### 3.1 Design and Participants

This was a descriptive cross-sectional study lasting 2 months, carried out by the Regional Observatory of Ambulatory Surgery (ORCA), which is a regional working group set up by the Ile-de-France Regional Health Agency (ARS IDF). Surgeons whose contacts exist in the ORCA and ARS IDF database were asked to participate in the study. Responses received from 01 May to 31 June 2021 have been taken into account.

### 3.2 Data Collection

Data concerning socio-professional information (age, gender, surgical discipline, and mode of exercise), level of knowledge on sustainable development (definition of sustainable development – the proportion of the impact of the operating theatre on the environment – the proportion of the impact of the transport of patients and health personnel on the environment – the difference between waste from Infectious Risk Care Activities and Waste Assimilated to Household Waste – the impact of anesthetic products on the environment – the amount of water for cataract surgery the proportion of instruments desterilized and not used) and the practical attitudes of their respective establishments to reduce the impact of surgical activities on the environment (Ventilation and air conditioning of operating theatres outside intervention - Use of single-use kits – existence of a charter and a sustainable development committee within the establishment – special action of sustainable development in the establishment). Data were collected using an online questionnaire (google forms) which was sent, by email to all the surgeons who are part of the database of the Regional Observatory of Ambulatory Surgery and also of the surgery thematic group of the Regional Health Agency of the Ile-de-France.

### 3.3 Ethical Aspect

This study was carried out with the agreement of the surgeons. The data was anonymized and the consent of the surgeons for the use and analysis of the information provided was collected before their participation.

### 3.4 Statistical Analysis

We described the socio-professional characteristics of surgeons, their level of knowledge about sustainable development, and the practical attitudes of institutions to reduce the impact of surgical activities on the environment, and then established a score of level of knowledge based on the seven questions related to the subject. The results are expressed in a table as a mean and standard deviation for quantitative variables, and as numbers and percentages for qualitative variables. The student t-test and the ANOVA were used for the comparison of means, Pearson's or Yates' Chi2 test was used to identifying statistical differences between proportions. A threshold of 5% has been set for the p-value.

## 4. Results

Out of a total of 457 surgeons solicited, 131 responded to our questionnaire, a response rate of 28%. The average age of surgeons was 46.79±11.18 years, 68 were men (52%) and 63 were women (48%). The majority of surgeons (32%) practiced in private institutions. Gynecologists (29%) and orthopedists (21%) were the most represented (Table I).

The level of knowledge of surgeons is low regarding sustainable development with an average of 2.7±1.11 correct answers to the 7 questions: 48.9% of participants had a low level (score between 0 and 2 out of 7), 43.5% a medium level (score between 3 and 4 out of 7), and 7.6% a high level (score between 5 and 7 out of 7). The practical attitude of surgeons and health facilities is described in Table II. Half (51%) of the surgeons traveled by car to the hospital, 23% and 12% used bicycle and public transport respectively. The SD charter is only available in 23% of establishments, only 19% of establishments have an SD committee and specific actions in sustainable development are carried out in only 27% of establishments. The level of knowledge is related to the age and the means of transport used. Surgeons who are between 30 and 45 years old have an average level of knowledge, higher than those who are over 45 years old (3.08 vs 2.34) ($p<0.001$). Bicycle drivers and those who use public transport have an average level, higher than those who travel by personal car or motorcycle/scooter (3.26 vs 2.45) ($p=0.005$). Differences in the level of knowledge between different genders, modes of exercise, and surgical disciplines are not statistically significant (Table III).

**Table I:** Socio-professional characteristics of surgeons in Île-de-France in May 2021.

| Variables | n=131 | % |
|---|---|---|
| **Age (46,79±11,18)** | | |
| 30 - 35 years | 32 | 24,43% |
| 35 - 45 years | 32 | 24,43% |
| 45 - 55 years | 21 | 16,03% |
| 55 - 65 years | 46 | 35,11% |
| **Sex** | | |
| Wife | 63 | 48,09% |
| Man | 68 | 51,91% |
| **Respondent's mode of exercise** | | |
| CH | 29 | 22,14% |
| CHU | 30 | 22,90% |
| ESPIC | 18 | 13,74% |
| Mixed | 12 | 9,16% |
| Private | 42 | 32,06% |
| **Surgical discipline** | | |
| Cardiac surgery | 3 | 2,29% |
| Gynecological surgery | 38 | 29,01% |
| Childhood surgery | 4 | 3,05% |
| Maxillofacial-stemmatological surgery | 3 | 2,29% |
| ENT surgery | 12 | 9,16% |
| Orthopedic surgery | 28 | 21,37% |
| Plastic surgery | 3 | 2,29% |
| Thoracic surgery | 2 | 1,53% |
| Urological surgery | 8 | 6,11% |
| Visceral and digestive surgery | 24 | 18,32% |
| Ophthalmology | 6 | 4,58% |

**Table II:** Practical attitudes of surgeons and institutions in the Ile-de-France region towards sustainable development in May 2021.

| Variables | n | % |
|---|---|---|
| **Means of transport** | | |
| On foot | 9 | 6,87% |
| By bike | 31 | 23,66% |
| Metro/RER | 16 | 12,21% |
| Motorcycle or scooter | 8 | 6,11% |
| Car | 67 | 51,15% |
| **Duration of transport** | | |
| Less than 30mn | 90 | 68,70% |
| Greater than 30 | 41 | 31,30% |
| **Using Single-Use Kits for Small Surgeries** | | |
| I don't know | 2 | 1,53% |
| Not | 67 | 51,15% |
| Yes | 62 | 47,33% |
| **Air conditioning on out of intervention** | | |
| I don't know | 38 | 29,01% |
| Not | 17 | 12,98% |

| | | |
|---|---|---|
| Yes | 76 | 58,02% |
| **Existence of an SD charter in the institution** | | |
| I don't know | 53 | 40,46% |
| Not | 47 | 35,88% |
| Yes | 31 | 23,66% |
| **Special actions of SD in the establishment** | | |
| I don't know | 46 | 35,11% |
| Not | 49 | 37,40% |
| Yes | 36 | 27,48% |
| **Sustainable Development Committee in the institution** | | |
| I don't know | 57 | 43,51% |
| Not | 48 | 36,64% |
| Yes | 26 | 19,85% |

**Table III:** Bivariate analysis of variables related to the level of knowledge.

| **Variables** | **n** | **Average ± SD** | **p** | |
|---|---|---|---|---|
| **Age** | | | | |
| 30 - 45 years | 32 | 3,08±1,07 | <0,001 | |
| 45 - 65 years | 21 | 2,34±1,02 | | |
| **Sex** | | | 0,08 | |
| Wife | 63 | 2,87±1,16 | | |
| Man | 68 | 2,54±1,04 | | |
| **Exercise mode** | | | 0,39 | |
| CH-CHU | 59 | 2,78±0,95 | | |
| ESPIC-PRIVE | 60 | 2,64±1,21 | | |
| **Mixed** | 12 | 2,67±1,38 | | |
| **Surgical discipline** | | | 0,13 | |
| **Other** | 29 | 2,32±1,23 | | |
| Gynecological surgery | 38 | 2,98±1,03 | | |
| ENT surgery | 12 | 3±0,74 | | |
| Orthopedic surgery | 28 | 2,72±1,28 | | |
| Visceral and digestive surgery | 24 | 2,59±0,93 | | |
| **Means of transport** | | | 0,005 | |
| On foot | 9 | 2,23±0,98 | | |
| By bike | 31 | 3,26±1,13 | | |
| Metro/RER | 16 | 3±1,22 | | |
| Motorcycle or scooter | 8 | 2,63±0,75 | | |
| Car | 67 | 2,45±1,04 | | |

**Table IV:** Bivariate analysis of practical attitudes of health facilities by legal status.

| Variables | Public* | Private** | P |
|---|---|---|---|
| **Using Single-Use Kits for Small Surgeries** | | | 0,51 |
| Yes | 29 | 25 | |
| Not | 30 | 33 | |
| **Air conditioning on out of intervention** | | | 0,31 |
| Yes | 37 | 31 | |
| Not | 6 | 9 | |
| **Existence of an SD charter in the institution** | | | 0,83 |
| Yes | 13 | 15 | |
| Not | 22 | 23 | |
| **Special actions of SD in the establishment** | | | 0,95 |
| Yes | 17 | 16 | |
| Not | 25 | 23 | |
| **Sustainable Development Committee in the institution** | | | 0,06 |
| Yes | 14 | 10 | |
| Not | 16 | 29 | |

SD: Sustainable Development

* public institution: hospital center and hospital and university center

** private establishment: ESPIC and private

## 5. Discussion

Sustainable development is an emerging issue and has been widely discussed in the health sector. Considerable literature focused on the need for efficient and effective sustainable health care is being developed [16]. However, while surgeons face multiple challenges in providing quality surgical care, sustainability is considered a lower priority topic by most surgeons, to achieve an adjustment for the future. And yet, the share of surgical activities in the environmental impact is not negligible, and similarly to the various studies in the literature [12,13] this study reports a low level of knowledge of surgeons on sustainable development. A good level of knowledge of surgeons is crucial to integrate sustainability into operating theatres. This low level of knowledge is a barrier in the application of guidelines aimed at reducing the environmental impact of surgical activities. Given the importance of knowledge, experts consider it crucial to invest in knowledge improvement to optimize the performance of healthcare organizations [17]. Half of the surgeons drove to their workplace, and those who use ecological means of transport represent only a third of the respondents. The level of knowledge of surgeons is related to the means of transport used. Those who seem committed to sustainable development and have a somewhat high level of knowledge, use environmentally friendly means of transport. Studies conducted on the ecological transition of operating theaters have initiated several measures that hospital management and the surgeons can take to reduce the ecological footprint of operating theatres. These initiatives include the 5 "Rs" of waste management: reduction, reuse, recycling, research, and renewable energies [4,6]. A "power off" initiative to turn off all anesthesia and operating room lights and unused equipment saved $33,000 and reduced CO2 emissions per year by 234.3 metric tons [18]. The formation of an RO committee dedicated to green initiatives can provide a significant opportunity to improve the impact of healthcare on the environment and save money [18]. In a world where greenhouse gas emissions are causing unprecedented climate change and landfill space is limited, hospitals have a responsibility to help reduce the environmental impact of their facilities[6] This reduction would limit its impact on the health of the population and save funds for the health system and society as a whole. Today surgery has a unique opportunity to move on to the ecological transition of operating theatres.

This study did not find a statistically significant difference between the practical attitudes of private institutions and those of public institutions. The involvement of public policies/health authorities through motivating supportive projects could have a positive impact on the commitment of health institutions to reduce the impact of surgical care on the environment. Barriers to improving waste management include low levels of knowledge, lack of leadership, misconceptions among staff, and overall resistance to change. Health systems also face several challenges in terms of the provision of care, and the adoption of a sustainable development policy in health care is not yet expected to our knowledge. This would explain the fact that very few health facilities, especially operating theatres, have good attitudes towards actions to reduce the impact of carbon. The representativeness of our sample is not effective:

not all surgeons in the Ile-de-France region have the same chance to participate; our mailing list is not exhaustive and participation is voluntary. The final size of our sample is sufficient for the statistical tests carried out. Our questionnaire included only about twenty questions that cover relatively all the axes of sustainable development, which is quite suitable for surgeons.

## 6. Conclusion

The level of knowledge of surgeons in Ile-de-France on sustainable development is insufficient: surgeons who have a higher level of knowledge use ecological means of transport. About good practices for reducing the impact of operating theaters on the environment, very few establishments apply these measures. We found no statistically significant links between the application of good practices in terms of sustainable development and the status of institutions (private or public). It is necessary to deepen the knowledge of surgeons on this subject to improve their involvement. It is also important to set up support projects to motivate health institutions to better organize operating theatres to reduce their impact on the environment.

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