

## How Can We Reduce the Environmental Impact of Obstetric Anaesthesia?

Sustainable healthcare is a term that is becoming ever more familiar to those of us who choose to listen to what is happening around us. The goal of sustainable healthcare is to provide an environmentally friendly, high quality care system which improves public health. To many, the “triple bottom line” is the fundamental aim in marrying together financial, social and environmental benefits of any investment; which would be of huge significance to the NHS as a whole as well as individual health boards, hospitals and departments<sup>1</sup>.

The Climate Change Act 2008 depicts the UK government law to reduce “greenhouse gas emissions by at least 100% of 1990 levels (net zero) by 2050”<sup>2</sup>. In addition to this, they aim to reduce the carbon footprint of health and social care by 34% by 2020 and 51% by 2025<sup>2</sup>. In keeping with these legislations the NHS set out a long term plan to “lead by example in sustainable development and reducing use of natural resource”. The long term plan specifically targets anaesthetic practice to reduce the overall NHS carbon footprint by 2%<sup>3</sup>.

### Raw Materials

When considering methods for improving sustainability within healthcare, including obstetrics, it is logical to start with the materials used to power our industry. The majority of resources for energy are not from sustainable sources with the use of fossil fuels now widely recognised as contributing to accelerated global warming<sup>4</sup>. Should we consider the need to make sustainable sources of energy such as solar or wind more mainstream and incorporated into our healthcare systems? Should we be calling on the government to make this mandatory for businesses?<sup>4</sup>. As anaesthetists we rely heavily on the use of and feedback from electronic equipment; electronic patient notes, monitoring,

medication pumps, anaesthetic machines, thus switching to non-fossil fuel energy would alter the impact of our everyday work.

We can also aim to reduce our use of energy within the work place. Simple measure such as turning off lights, computers and other electronic devices and machines that are not in use, especially out of hours, would not only act as a cost saving method but also reducing use of precious energy<sup>4</sup>. Within the obstetric department we must find a balance of ensuring the environment is suitable and ready to cope in the event of an emergency, thus not requiring time for electronic equipment to turn on and start up, but also to minimise the unnecessary constant electronic activity. Switching to motion censored lighting in obstetric theatres and delivery suites could reduce light usage and ensuring anaesthetic machines and monitors that are not in use out of hours are switched off.

### Manufacture and Procurement

The majority of the NHS's carbon footprint, up to 70%, comes from the procurement process of goods and services<sup>5</sup>. Sustainable procurement practices, via building strong connections with supply chain, allow us to demand and drive change in ethical and sustainable procurement<sup>6</sup>. We can demand these changes through links with industry representatives that are commonplace in anaesthetic practice; frequently pharmaceutical or manufacturing representatives meet with anaesthetic teams to engage and advertise their products. If we insisted on green procurement, industry would have no choice but to oblige in order to continue the supply and demand process. The Public Procurement Directive (PPD) 2014 aimed to “modernise public procurement rules and enable governments to manage the operational requirements of efficient procurement”, allowing a more innovative, sustainable, inclusive and competitive economy<sup>4</sup>.

Companies are also being encouraged to undertake full life cycle analysis (LCA) of their products, which details cost and carbon footprint in an entire products lifetime. The LCA then must be accessible to consumers at point of purchase. If this became law it would raise awareness of the environmental cost of manufacturing and disposal, thus force us to reconsider the need, use and

waste of products in everyday practice. Along with the LCA idea, the concept of circular economy is growing. Circular economy aims to “decouple economic activity from the consumption of finite resources and designing waste out systems”<sup>7</sup>. In other words creating products that can be reused or recycled to be re-made and powering systems with renewable energy, as mentioned above<sup>8</sup>.

### Transport

Part of the LCA is transport of products into industries. Can we demand more control over where our equipment is sourced from? Encouraging local buying not only improves local economic growth but reduces the carbon footprint of our materials through long-haul transport chains with mass usage of fossil fuels of vehicles used in the process<sup>8</sup>.

### Usage

Anaesthetic practice, specifically anaesthetic gases contribute to 5% of the carbon footprint of acute healthcare organisations<sup>3</sup>. Nitrous oxide (N<sub>2</sub>O) emissions are estimated to be over five times the amount of any other anaesthetic gas for NHS England<sup>9</sup>. In order to study and monitor the impact of anaesthetic gases the global warming potential (GWP) for agents can be used to calculate carbon dioxide emission equivalents. When considering the environmental impact of gasses one must consider the atmospheric lifetime of the gas and thus its contribution as a greenhouse gas. Nitrous oxide has an atmospheric lifetime of 114 years, with a GWP more than 300 times that of carbon dioxide<sup>10</sup>. Generally, anaesthetic use of N<sub>2</sub>O is declining<sup>11</sup> with obstetric anaesthesia and paediatric anaesthesia still remaining to be the major contributors in its use.

In considering labour analgesia, N<sub>2</sub>O is used routinely in UK hospitals for labour analgesia, yet these practices vary widely across the globe<sup>11</sup> with very little access to its use in the US<sup>12</sup>. Routinely a 50% mix of N<sub>2</sub>O and oxygen, Entonox, is used with a largely safe and efficacious result<sup>11</sup>. BOC, who are the largest provider of industrial, medical and special gases in the UK, in their “Essential guide to Entonox” state that “Chapman et al. found

that 20-30% nitrous oxide had a comparable pain relieving effect to 15mg of subcutaneous morphine”<sup>14,15</sup>. Therefore, in order to reduce obstetric contributions to N<sub>2</sub>O emissions could we consider reducing the concentration within our delivery systems to limit the amount of N<sub>2</sub>O used? Central neuraxial block (CNB) techniques are considered the gold standard of care<sup>16</sup> yet first line epidurals are not current practice in the UK. This is largely due to the complication risk profile including headache, infection and nerve damage. Nonetheless according to the third National Audit Project run by the Royal College of Anaesthetists (RCoA) data suggests that “CNB has a low incidence of major complications, many of which resolve within 6 months”<sup>17</sup>. More specifically, it is also evidenced that incidence of permanent harm from obstetric epidural was extremely low (0.6)<sup>17</sup>. Perhaps we should consider expanding our use of CNBs for labour analgesia, as is common practice in the US<sup>13</sup>.

Consideration must also be paid to other methods of labour analgesia in order to limit the use of N<sub>2</sub>O. A study comparing remifentanyl intravenous analgesia with N<sub>2</sub>O use during labour found that pain scores were in fact preferable with remifentanyl and largely favoured by parturients<sup>18</sup>. Epidural analgesia and parenteral opioids are also included in the WHO recommendations for intrapartum care<sup>19</sup>. In addition to pharmacological interventions, more routine access to non-pharmacological methods to reduce pain in labour is also an intriguing prospect. The WHO recommend relaxation techniques including muscle relaxation, breathing, meditation, mindfulness and music. They also state that provision of such services could have large implications on the need for labour analgesia<sup>19</sup>. In an ideal healthcare system unlimited access to all branches of non-pharmacological therapy would be provided to labouring women, however we must be realistic in our current economic limitations. Thus, it could be proposed that improved education through antenatal care to empower women to self-direct their own preparation of preferred non-pharmacological methods may prove highly beneficial.

Provision of anaesthesia for Caesarean or instrumental delivery is widely provided through regional techniques<sup>20</sup> with declining rates of general anaesthesia being recorded<sup>21</sup>. Regional techniques have

the lowest environmental impact of anaesthetic techniques, avoiding the use of anaesthetic gases and minimising the associated waste through use of little equipment.<sup>22</sup> When general anaesthesia is required in obstetric anaesthesia, the anaesthetist should aim to limit the use of N<sub>2</sub>O where possible and limit fresh gas flows and partial pressures of anaesthetic gases to a minimum, yet clearly avoiding the risk of awareness. Consideration should also be given to TIVA to once again minimising the use of volatile anaesthetic agents<sup>22</sup>.

The ongoing debate between single use or reusable equipment is as strong as ever. Traditionally, equipment was chosen based on cost, patient safety, efficacy and ease of use, however it is becoming more important to include environmental impact in that decision<sup>23</sup>. Much of our obstetric anaesthetic equipment is reusable for example pumps, monitoring blocks and laryngoscope blades and handles. The benefit of reusable products is avoiding the ongoing carbon footprint of manufacturing and the contribution of waste to landfill or incinerators<sup>22</sup>. It may also be argued that reusable products are of higher quality and reliability. Nonetheless, the disinfection or sterilisation solutions can be harmful and cause contamination of the environment including water supplies<sup>23</sup>. Disposable equipment may conversely actually be more reliable, essentially being brand new, thus eliminating wear and tear through use and also eliminate the economical and ecological costs of cleaning<sup>23</sup>.

Anaesthetists can also consider reducing their usage and thus improving sustainability of obstetric anaesthesia by reducing the number of drugs routinely drawn up. For example, it is commonplace in most anaesthetic practice to draw up a tray of emergency drugs. Atropine, however, is rarely used and can be rapidly accessed via a pre-filled syringe in the event that it is required. Despite a higher price tag its reduction in unnecessary wastage benefits economy and improving sustainability<sup>23</sup>.

### Recycling

More often than not, recycling is the main topic considered when trying to be “environmentally friendly”. This is because it is familiar to us in our domestic lives, simple to instigate and now

widely accepted behaviour. A report from the Department of Anaesthesia at Western Hospital in Australia noted that anaesthesia waste stream represented 25% of the total operating room waste with 60% of anaesthetic waste being recyclable<sup>24</sup>. Anaesthetists generate substantial amounts of recyclable waste in preparation for each theatre case. The ease of recycling can be improved with the provision of segregated bins for different recyclable materials. Separating waste into separate bins is already commonplace with segregation of hygiene waste, infectious materials, normal landfill etc, thus an additional recycling bin would easily become second nature to reduce our volumes of waste sent to landfill. Posters alerting teams as to which materials and products can be recycled is a simple yet efficient way of improving education and awareness and ease of recycling. The cost of recycling is also substantially less than that of landfill or incineration so there is a financial incentive to increasing recycling and minimising waste<sup>23</sup>.

There are also companies which exist who arrange commercial waste disposal including recycling of plastic waste that is not collected through the normal recycling channels. Largely, however, this is dependent on local facilities. Nonetheless, where these companies exist, this recycling method, once again, creates a financial incentive for environmental sustainability.

We can also consider more routine recycling of products such as pens and batteries which are frequently used in anaesthetic practice.

The disposal of monitoring equipment, computers and anaesthetic machines also contribute to the anaesthetic environmental impact. Much of this large equipment contain recyclable metals such as stainless steel, aluminum, and copper which can be recovered by metal recycling facilities<sup>23</sup>.

Consideration should be given to liaison with local recycling plants as to the potential for successfully implementing this recycling as a norm in our practice. Refurbishment or repurposing for parts of unwanted anaesthetic equipment should also be considered and either sold or donated to other industries such as laboratories or charitable organisations and developing countries<sup>23</sup>.

## Waste

Reduction of waste correlates with increasing recycling and reusable equipment as mentioned above. Importantly the collection of sharps container waste is very expensive and disposal utilises harsh pollutant chemicals<sup>23</sup>. In anaesthetics due to the number of different drugs drawn up for different patients we create masses of sharps waste from needle to glass vials. However, we have all been witness to inappropriate disposal of non-sharp objects into the sharps bins. “Green champions” should encourage proper use of the sharps containers<sup>23</sup> so reduce the economical and environmental burden of their disposal.

## Education

All environmental sustainability should ultimately start with improving education. As anaesthetists we work with numerous specialties in a variety of environments in the hospital. Within obstetric anaesthesia this covers; obstetric and gynaecology doctors, midwives, nurses, healthcare assistants and domestic staff. We are, therefore, the ideal advocates to increase awareness of the importance of sustainable healthcare and championing methods to ensure this ideal is aimed for.

There are many ways in which we can drive this improved education, one of which being the Carbon Literacy Project<sup>25</sup>. The project aims to provide individuals with access to learning portals to become carbon literate and help them make changes within their wider environments, including workplace<sup>25</sup>. Moreover, the Sustainable Development Unit is an organisation funded by NHS England and Public Health England to work towards mitigating the impacts of healthcare on the environment. The SDU have also published guidance for writing sustainable development management plans, which can be introduced into the healthcare workplace<sup>1</sup>. We can take these programmes and introduce them into our everyday obstetric anaesthetic practice to not only steer personal involvement but to educate others into also becoming green champions.

The RCoA are also becoming more aware of the importance of the anaesthetic environmental impact, with the introduction of sustainability into the RCoA curriculum. In March 2019 the RCoA released a sustainability strategy 2019-2022 detailing its aims for improving the anaesthetic burden for the environment<sup>26</sup>. We can therefore advocate sustainability, producing guidance and leadership<sup>23</sup> encouraging our colleagues in other specialties to introduce sustainability into the obstetric and midwifery curriculum and local teaching programmes.

There is a huge focus in healthcare on quality improvement, completing audit loops and essentially growing and improving practice. We should place a greater focus on regular sustainability projects within obstetric anaesthesia to show progression and benefits. It is also beneficial to share these projects across health boards to engage the wider community and encourage innovation in environmental impacts. We can then continue this to raise awareness at national and international conferences<sup>23</sup>.

The GMC have also stated that all newly qualified doctors should be educated in sustainable healthcare as seen in the Outcomes for Graduates 2018<sup>27</sup>. We should therefore hopefully develop a workforce with improved knowledge and motivation to enhance our sustainability within obstetric anaesthesia and the NHS as a whole.

Anaesthetic practice, including obstetric anaesthesia contributes a large percentage of the carbon footprint of the NHS, which also contributes greatly to the overall carbon emissions. In line with the initiatives set out by UK government and the NHS Long term plan, we need to think logically and act immediately to hinder the progression of climate change. “As healthcare providers, should we not be championing the “do no harm” motto in altering our practices to ensure we are providing a sustainable, eco-friendly system instead of contributing masses to landfill, ozone depletion and contamination of water systems.”<sup>22</sup>

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