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Driving down embedded emissions from medical nitrous oxide

Introducing a sustainability variable into NHS procurement and intervention decisions could reduce healthcare's climate impact, writes Alifia Chakera

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When I joined NHS Lothian, sustainably minded colleagues despaired about our persistently high medical nitrous oxide emissions. And with good reason—nitrous oxide is a potent greenhouse gas. Pound for pound, it has 298 times the global warming potential of carbon dioxide.¹ With the near elimination of chlorofluorocarbons it is now the dominant ozone depleting substance released into the atmosphere.² Its long atmospheric life of 120 years, allows it to accumulate in the atmosphere, destabilising the climate now, and for generations to come.

My research with the University of Edinburgh revealed that within healthcare much of this anaesthetic gas is lost through poor system design, overspecification of supply, poor stock management, theft, and system leaks. With this knowledge I established The Nitrous Oxide Project, which aims to eliminate all emissions of medical nitrous oxide.³ The team is working to achieve this by educating healthcare teams on waste mitigation methodologies, encouraging environmentally favourable anaesthetic practice, and assessing and applying the most appropriate green technologies.

The excitement associated with the progress of the Nitrous Oxide Project within the sustainable healthcare community is palpable as we finally have a road map to eliminate direct emissions of medical nitrous oxide within healthcare settings.

This significant system waste has perpetuated for decades for several reasons, but the most fundamental reason is that clinicians had assumed that use alone was driving supply, rather than querying the supply itself. As a pharmacist, I knew the process of supplying medical gases was often vague within a hospital site and I found myself asking about the agent's true use, its movement, and management as it was supplied into the hospital. This altered the lens by which we viewed the problem and yielded an entirely different narrative focusing on the necessity and leanness of nitrous oxide supply within healthcare settings.⁴

However, there are further concerns to be explored and understood regarding the cradle-to-grave analysis of this agent and its associated carbon footprint throughout its lifecycle. At an NHS site level, nitrous oxide emissions are classified as Scope 1 as they are directly emitted into the environment and are calculated from the cylinders returned to the medical gas supplier.⁵ Present Medicines and Healthcare products Regulatory Agency (MHRA) guidance aligns with European Commission regulations requiring that all cylinders returned to the supplier, be evacuated before refilling, without

the obligation to catalytically split this gas into environmentally inert oxygen and nitrogen.^{6,7} Thus, these returned gases are part of the NHS' climate damage. Additionally, while the Nitrous Oxide Project addresses site level scope 1 nitrous oxide emissions, it does not account for the embedded carbon or Scope 3 emissions from material processing, manufacture, distribution, and disposal of this agent by medical gas suppliers. This needs to change.⁸

Most NHS emissions are associated with supply chains, about 15 mega tonnes in England alone.⁹ The insult on health associated with NHS related road mileage is estimated to be £345 million per annum in respiratory treatment costs exclusively.¹⁰

At present, decisions made to procure a drug, device, or consumable have little or no sustainability weighting. Traditional health economic models assess the value of an intervention using Quality Adjusted Life Years (QALYs) or Disability Adjusted Life Years (DALYs). Describing a cost to benefit ratio of any projected intervention for a patient excludes the insult to health caused by providing the intervention itself. In delivering our present healthcare system we are inflicting injury to public health via untenable climate damage. We cannot afford to trivialise this. It is vital we include meaningful sustainability metrics into procurement decisions.

Now that we understand this public health paradox created by delivering healthcare, it is obvious that we need to drive innovation in sustainable procurement. One viable procurement innovation tool that I am keen to test against nitrous oxide procurement is the Health Climate Economic (HCE) model proposed by Ethar Alali and colleagues.¹¹ The HCE does not exclude traditional health economic tools but introduces a sustainability factor to aide procurement decisions and model the effect of climate impacts through whole-system life cycle assessment. This creates a purchasing preference by establishing a mathematical saddle point which integrates and quantifies the interdependency between patient outcome, costs, and sustainability, and compares it to current incumbents.

Furthermore, integration of a sustainability variable into purchasing decisions introduces market competition against this metric; as suppliers must not only compete on price, service, and quality, but also environmental sustainability. The long term benefit of this is to drive down total embedded emissions, which improves health by proxy. Whereas "flat rate" measures that bury climate impacts inside a 10% "social good" metric are profoundly insufficient to accurately capture the complex dynamics inside the NHS.¹² These so-often cut across

multiple medical and estates workstreams and create a disconnect from the original buying decision which are currently invisible to our procurement colleagues. Here, tools like HCE offer us a chance to visualise the invisible.

We cannot afford to procrastinate in our application and scrutiny of new models to drive innovation in procurement. These approaches are not a panacea to our dreadful carbon predicament, but offer a chance to remedy an existing model that is failing to deliver a low carbon health service.

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