IMJ
Official Journal of the Irish Medical Organisation

Ir Med J; May 2024; Vol 117; No. 5; P961
23rd May, 2024

The environmental impact of nitrous oxide for labour analgesia: A survey of midwives' attitudes

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Abstract

Aims

To assess midwives' knowledge of, and attitudes to, the environmental impact of nitrous oxide (N_2O) for labour analgesia.

Methods

A survey was carried out amongst 32 midwives working on our delivery suite, representing 44% of the midwifery staff (32/72).

Results

The majority (21/32 [65.6%]) of midwives in our survey were not aware of the environmental impact of N_2O. The majority (24/32 [75%]) felt that pregnant women should be informed about the environmental impact of N_2O, but just over half felt that this environmental impact should influence our decision to offer it as labour analgesia. A majority of midwives surveyed (19/32 [59%]) felt that it would not be possible to provide labour analgesia without N_2O.

Discussion

These results indicate that while education may be useful to inform midwives regarding the negative environmental impact of N_2O, alternative analgesic care pathways will be required to replace it if care providers intend to pursue initiatives aiming to minimise its use.

Introduction

Nitrous oxide (N_2O) is an anaesthetic gas used for its analgesic benefits in labour[1] It is the most commonly used labour analgesic in many countries worldwide[2]. N_2O is self-administered by the patient

using an inhalational nozzle in the form of 50% oxygen and 50% nitrous oxide, commonly known as 'Entonox'[3]. It is usually well tolerated, although side effects may include nausea, vomiting and dizziness[1,4].

However, N_2O is also recognised one of the most environmentally harmful anaesthetic gases. This is due to both its significant global warming potential of 273 (compared to the global warming potential of carbon dioxide which is 1) and its lifespan of 120 years[5]. The use of nitrous oxide in labour has been described as creating the same carbon emissions as driving a vehicle 1,400km. Analgesia via epidural or remifentanil pump creates a 7km equivalent in emissions for the same time-frame(6). Epidural analgesia is also recognised as the most effective analgesia in labour[7]. In Ireland, approximately 4.4% of national greenhouse gas emissions are attributable to the Irish Healthcare Service[8]. In the UK, N_2O contributes 2% of the total NHS England Carbon footprint and 75% of the total anaesthetic gas foot-print[9]. In Scotland, the NHS has introduced a 'Nitrous Oxide Mitigation Plan' to work towards reducing and eventually eliminating N_2O from clinical use[10]. This inquiry reported that 83-100% of N_2O was being leaked into the environment prior to its use in some centres[11]. The use of N_2O as a labour analgesic typically results in inhaled N_2O being exhaled into the clinical atmosphere and subsequently into the external atmosphere. In 2021, Ireland had the second highest emissions of greenhouse gases per capita in the EU27, ranking fifth worst out of 27 EU Member States in terms of its total greenhouse gas emissions[12].
Ireland was 3rd in the European Union in terms of percentage increase in greenhouse gases in the last quarter of 2023[13].

N_2O for labour analgesia, is most commonly provided by the patient's midwife. Despite this, there are limited data assessing midwives' knowledge regarding the environmental impact of nitrous oxide, and their attitudes towards this. Therefore, the aim of this study was to investigate midwives' knowledge regarding the negative environmental impact of N_2O and their opinion on the use of N_2O in the setting of obstetric anaesthesia.

Methods

This study was approved by the ethics committee at our centre. The target population for the survey were the midwives working on the delivery suite (DS), who are the main providers of N_2O for women in labour in our hospital. We provided the midwives working on the delivery suite with a ten-point, anonymised, qualitative survey (Table 1).

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Results

This survey was completed by 32 midwives practising on the DS. This represents 44% (32/72 total) of the midwives working on the DS in our centre. The majority (20/32 [62.5%]) of surveyed midwives had over 5 years of experience in midwifery. The majority of midwives were moderately (22/32 [68.8%]) or very (8/32 [25%]) concerned about climate change and the environment. While the majority (28/32 [87.5%]) of midwives were aware that health care can contribute to global warming, only a minority (11/32 [34.4%]) were aware that N_2O is environmentally harmful. When informed regarding this, just over half (18/32 [56.3%]) agreed that the negative environmental impact of N_2O should influence the decision to offer it as labour analgesia. The majority (24/32 [75%]) thought that pregnant women should be informed regarding the negative environmental impact of N_2O. The majority of midwives considered N_2O somewhat (19/32 [59%]) or very (12/32 [37.5%]) effective for pain relief in labour and most (19/32 [59%]) midwives thought it would not be possible to provide labour analgesia without it.

Discussion

Our results indicate that the majority of midwives in our centre are unaware of the environmental impact of N_2O use. When informed regarding this negative environmental impact, most midwives were concerned and felt that pregnant women should be informed. The majority of midwives consider N_2O only somewhat effective for analgesia, although only a minority felt it would be possible for them to provide labour analgesia without it. This reliance likely stems from a lack of suitable alternatives to N_2O. However, the harmful effects of N2O can be mitigated in various other ways such as reducing leakage from existing manifold pipes, or through gas capture technologies which 'crack' N_2O into inert nitrogen and oxygen (costed at £200,000 for a central manifold)[14], thereby decreasing direct emissions into the environment. A collaborative strategy involving expectant mothers, delivery suite teams, and antenatal services to investigate and discuss a comprehensive range of pharmacological and non-pharmacological options may be the most appropriate way forward. The future of N_2O as a labour analgesic requires prompt review.

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Table 1. The results of the ten point survey delivered to midwifery staff

Q1. How many post-qualification years of experience in midwifery do you hold?
0-5 years = 12 (37.5%)
5-10 years = 9 (28.1%)
10-20 years = 5 (15.6%)
20-30 years = 4 (12.5%)
>30 years = 2 (6.3%)
Q2: How would you rate your level of concern about climate change and the environment?
Not at all concerned = 2 (6.2%)
Moderately concerned = 22 (68.8%)
Very concerned = 8 (25%)
Q3: Are you aware that certain aspects of health care can negatively impact the environment and contribute significantly to global warming?
Yes = 28 (87.5%)
No = 4 (12.5%)
Q4: Are you aware that nitrous oxide (Entonox), an anaesthetic gas used for labour analgesia, is harmful to the environment?
Yes = 11 (34.4%)
No = 21 (65.6%)
Q5: On average, the carbon footprint resulting from the use of Entonox during labour is equivalent to that produced by a typical passenger vehicle driven over a 30-day period. Does this concern you?
Yes = 28 (87.5%)
No = 4 (12.5%)
Q6: Do you think the negative impacts of Entonox on the environment should influence our decision to offer it as a form of labour analgesia?
Yes = 18 (56.3%)
No = 13 (40.6%)
Unsure = 1 (3.1%)
Q7: Do you think that pregnant women should be informed about the negative impacts of Entonox on the environment?
Yes = 24 (75.0%)
No = 7 (21.9%)
No answer = 1 (3.1%)

Q8: What percentage of your labouring patients use Entonox?	
0-20% = 2 (6.3%)	
20-40% = 1 (3.1%)	
40-60% = 10 (31.3%)	
60-80% = 9 (28.1%)	
Q9: In your opinion, how effective is Entonox for pain relief?	
Not at all effective = 1 (3.5%)	
Somewhat effective = 19 (59%)	
Very effective 12 = (37.5%)	
Q10: Do you think it would be possible to provide labour analgesia without the use of Entonox?	
Yes 13 (41%)	
No 19 (59%)	

Declarations of Conflicts of Interest:
None declared.

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References:

1. Broughton K, Clark AG, Ray AP. Nitrous Oxide for Labor Analgesia: What We Know to Date. Ochsner J. 2020;20(4):419-21.
2. Vallejo MC, Zakowski MI. Pro-Con Debate: Nitrous Oxide for Labor Analgesia. Biomed Res Int. 2019;2019:4618798.

3. Collins MR, Starr SA, Bishop JT, Baysinger CL. Nitrous oxide for labor analgesia: expanding analgesic options for women in the United States. Rev Obstet Gynecol. 2012;5(3-4):e126-31.
4. Richardson MG, Lopez BM, Baysinger CL. Should Nitrous Oxide Be Used for Laboring Patients? Anesthesiol Clin. 2017;35(1):125-43.
5. Understanding Global Warming Potentials [Internet]. 2023.
6. al FPe. Estimate of the total carbon footprint and component carbon sources of different modes of labour analgesia. Anaesthesia 2022;(77) 4:1.
7. Pietrzak J, Mędrzycka-Dąbrowska W, Tomaszek L, Grzybowska ME. A Cross-Sectional Survey of Labor Pain Control and Women's Satisfaction. Int J Environ Res Public Health. 2022;19(3).
8. Ireland CoAo. 'Why it matters' [Available from: https://www.anaesthesia.ie/sustainability/why-it-matters/#:~:text=Any%20advancements%20in%20healthcare%20are,to%20the%20Irish%20Health%20Service.
9. healthcare Cfs. What we doSustainable Specialties Anaesthetics - The Nitrous Oxide Project [Available from: https://sustainablehealthcare.org.uk/what-we-do/sustainable-specialties/anaesthetics/nitrous-oxide-project.
10. Scotland N. Anaesthetic nitrous oxide system loss mitigation and management - Technical update. 2022.
11. Chakera A. NITROUS OXIDE MITIGATION IMPLEMENTATION PLAN. Open letter to Chief Executives. NHS Strategic Facilities Group Members. Directors of Pharmacy. Medical Directors. 2022;Government letter.
12. Environmental Indicators Ireland 2023 [Internet]. 2023 [cited 09.04.2024 Available from: https://www.cso.ie/en/releasesandpublications/ep/p-eii/environmentalindicatorsireland2023/greenhousegasesandclimatechange/#:~:text=4.2%20EU%3A%20Greenhouse%20gas%20emissions,base%20year%20of%202005%3D100.
13. Eurostat. Quarterly greenhouse gas emissions in the EU. 2023.
14. Chakera A. Evidence-based policy report - Reducing Environmental Emissions attributed to Piped Nitrous Oxide Products within NHS Hospitals NHS Scotland2021 [Available from: https://www.publications.scot.nhs.uk/files/piped-nitrous-oxide-products.pdf.