

Science Letter

Efficiency of nitrous oxide mix utilisation in NHS Trusts in England: a pilot study

Nitrous oxide is a greenhouse gas with a global warming potential approximately 300 times that of carbon dioxide. In UK hospitals, approximately two-thirds of nitrous oxide is utilised for labour analgesia [1], supplied as a 1:1 mix with oxygen ('nitrous oxide mix', hereafter). The Nitrous Oxide Project identified significant wastage in piped pure nitrous oxide, likely due to leaks and overordering [2]. Building on these observations, we used data collected routinely to explore evidence of pre-utilisation loss (i.e. drug waste that occurs without patient use) of nitrous oxide mix associated with NHS Trusts in England.

We obtained NHS England data for the financial year 2023/2024 on: the procurement of nitrous oxide mix across 198 NHS Trusts in England (based on the number of cylinders returned to suppliers, as recorded in the Greener NHS Dashboard) [3]; overnight bed availability and occupancy [4]; and the number and mode of births [5].

Because most nitrous oxide mix is utilised in maternity units [1], we focused our analysis on NHS Trusts with a maternity service. Data from 63 community and mental health Trusts and 15 Trusts without a maternity service were therefore not included, as were three Trusts with incomplete data, leaving 117 Trusts eligible for inclusion. To explore the efficiency of nitrous oxide mix utilisation and use in terms of Trust size and obstetric workload, we calculated the volumes of nitrous oxide mix procured annually per inpatient bed and per non-elective birth (defined as vaginal and non-elective caesarean births) for each eligible NHS England Trust.

The mean (SD) volume of nitrous oxide mix procured per non-elective birth was 1367 (650) l, with a range of 572–5619 l (Fig. 1A). The mean (SD) volume of nitrous oxide mix procurement per overnight bed was 6270 (6732) l with a range of 124–70,801 l (Fig. 1A). Fourteen trusts were in the top quartile for both the volume of nitrous oxide mix per non-elective birth and per overnight bed. Eighteen Trusts were in the bottom quartile for both measures.

At present, the limited data on the amount of nitrous oxide used in labour are based on estimations rather than clinical observations. For example, Pearson et al. based their calculation of the carbon footprint of labour analgesia on the inhalation of 14 l.min⁻¹ of nitrous

oxide mix for 18 min.h⁻¹, suggesting that 1008 l of nitrous oxide mix would be consumed over a 4-h period [6]. Our data show that some Trusts procure substantially more than this, and some substantially less. This variation in use highlights the limitations of using standardised assumptions about inhalation frequency and tidal volume to calculate the use of nitrous oxide mix during labour.

Limitations of this work relate principally to the measures used, which do not fully represent the variations in clinical practices and case mix between Trusts. Whilst this could be explained partly by practices not measured in this study (e.g. nitrous oxide mix used in endoscopy and emergency departments), and the relative size of maternity and non-maternity services, this is unlikely to fully account for the magnitude of the variance observed, given the predominance of obstetric use [1].

This exploratory analysis suggests that there is a large amount of nitrous oxide mix wastage in some NHS England Trusts. Further prospective research should explore the drivers of this variation and inefficiency and develop strategies to reduce it.

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Figure Legend

Figure 1 Volume of nitrous oxide mix procured per: A) non-elective birth; and B) overnight bed in NHS Trusts in England.