RESEARCH

S1 Appendix: construction of the 'intensity of active perinatal care' ratio

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We categorised hospitals into three levels, low, medium and high, according to a weighted calculation[1]of "perinatal intensity" based on admissions at 24 to 25 weeks' gestation.

First, each individual hospital was assigned an activity ratio according to the number of babies admitted into a neonatal intensive care unit at 24 to 25 weeks' gestation divided by the number of fetuses alive at maternal admission to hospital at the same gestations (equation 1).

$$\text{Activity ratio } (p_i) = \frac{\text{Number of babies admitted into NICU}}{\text{Number of foetuses alive at maternal admission to hospital}} \tag{1}$$

Using these ratios, the mean activity level across all included hospitals was obtained using formula shown in equation 2, where P_w is the overall weighted mean, p_i is the activity ratio in hospital i, and w_i is the weighting factor for hospital i:

$$P_w = \frac{\sum p_i w_i}{\sum w_i} \tag{2}$$

The weighting factors for individual hospitals were obtained using the formula shown in equation 3.

$$w_i = \frac{1}{\hat{\sigma}_p^2 + \frac{(\bar{p}(1-\bar{p}) - \hat{\sigma}_p^2)}{n_i}} \tag{3}$$

In this equation, $\bar{p}$ represents the unweighted mean activity ratio of all hospitals (obtained simply by summation of all the ratios and dividing by the total number of hospitals), and $\hat{\sigma}_p^2$ is the estimated standard deviation, which is obtained from the following equation:

$$\hat{\sigma}_p^2 = \frac{\sum (p_i - \bar{p})^2}{k-1} - \frac{\sum \frac{p_i(1-p_i)}{n_i}}{k} \tag{4}$$

Here, again, $\bar{p}$ is the unweighted mean activity ratio, p_i is the activity ratio for hospital i, n_i is the number of fetuses alive at maternal admission to hospital in hospital i, and k is the total number of hospitals.

Having calculated the mean activity level, 25^{th} and 75^{th} percentiles were obtained for different numbers of fetuses alive at maternal admission to hospital using equation 5:

$$25\text{th}/75\text{th percentiles} = P_w \pm 0.675(\frac{\sqrt{\hat{\sigma}_p^2}}{\sqrt{n}}) \tag{5}$$

where n is the number of foetuses admitted into hospital and $\hat{\sigma}_p^2$ is defined by equation 4. This enabled individual hospitals to be compared to the percentiles, and consequently permitting allocation to one of the three potential groups created (see figure 1 in the main article).

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