tional leaflet published by the National Society for the Prevention of Cruelty to Children and the Department of Health, *Handle with Care*, is a starting point for educating parents and other carers. This leaflet can be used by midwives and health visitors as a basis for individual work with parents, particularly targeting those considered to be most at risk.

We stated that shaking a baby is dangerous, and this is recognised by paediatricians. The purpose of the editorial and the campaign by the National Society for the Prevention of Cruelty to Children was to alert carers to the dangers of shaking infants and to offer help and support in dealing with stressful situations engendered by an infant's incessant crying. The hope is that, if carers are alerted when they are not stressed, they will refrain from inflicting injury during stress.

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Maternal haemoglobin and birth weight in different ethnic groups

Methods used do not support conclusions

EDITOR,—We have three comments on the methods used by Philip Steer and colleagues in their study of the relation between maternal haemoglobin concentration and birth weight.¹

Firstly, Steer and colleagues repeatedly refer to the fall in haemoglobin concentration. This implies comparison of two values. They use only the lowest haemoglobin concentration and are therefore relating birth weight to minimum haemoglobin concentration and not to the fall in haemoglobin concentration.

Secondly, they base their analysis on the lowest haemoglobin concentration during the pregnancy without taking into account the gestation at which haemoglobin concentration was estimated. Surprisingly, they do this despite emphasising the importance of the relation between gestation, expansion of plasma volume, and haemoglobin concentration.

Thirdly, they take no account of multiple pregnancies, in which low birth weight and premature labour are often seen in conjunction with low haemoglobin concentrations. Multiple pregnancies should have been excluded from the analysis, and this should have been made clear in the paper.

We think that the conclusion in the abstract that "the magnitude of the fall in haemoglobin concentration in pregnancy is related to birth weight" is not supported by the methods used.

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Study's conclusions are implausible

EDITOR,—I note that Philip Steer and colleagues used the word association to describe the relation they found between haemoglobin concentration and birth weight.¹ In their discussion, however, they suggested that haemoglobin concentration might be a determinant of birth weight. I refer, for example, to the statement: "There is a theoretical risk that increasing haemoglobin concentration might actually reduce birth weight and do harm," albeit that they do not claim that there is consistent evidence.

I am interested that Steer and colleagues thought causality in that direction was the most likely explanation. Would not a more plausible explanation be that a large fetus will have a greater iron requirement and therefore cause anaemia in the mother? And that, conversely, a small fetus will be less demanding on the mother's iron stores? Also, the fetus is not the only player here. Another important consideration is the effect that a low haemoglobin concentration has on the general wellbeing of the mother. Even if a low haemoglobin concentration did lead to high birthweight babies, and it is difficult to imagine the mechanism for this, the decision not to give iron supplements would have to be balanced against the presence of any symptoms of anaemia in the mother.

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Lower haemoglobin may be the result rather than the cause of larger fetuses

EDITOR,—Philip Steer and colleagues studied the relation between maternal haemoglobin concentration in pregnancy and birth weight and suggested that their results show that low haemoglobin concentrations are advantageous in improving fetal growth.¹ They even suggested a theoretical risk that treatment to improve haemoglobin concentrations may be detrimental to the fetus. They do not discuss the alternative explanation that lower haemoglobin concentrations are the result rather than the cause of larger fetuses. Expansion of plasma volume, and therefore haemodilution, is greater in association with larger fetuses, and this may account for the relation Steer and colleagues observed.

Garn *et al*, who studied a large cohort of American women,² previously described a U shaped relation between the lowest maternal haemoglobin concentration in pregnancy and poor outcome in the form of preterm delivery, low birth weight, or perinatal death. The lowest incidence of stillbirths occurred in association with haemoglobin concentrations between 90 g/l and 110 g/l. It was not clear from their study whether high haemoglobin concentrations were harmful or simply a reflection of poor plasma volume expansion in pregnancies that were failing to thrive.

Murphy *et al* found a similar curved association between haemoglobin concentrations at booking and perinatal mortality, but their results do not exclude the possibility that high haemoglobin concentrations at this early stage are the result of poor haemodilution.³ The increase in plasma volume begins from the start of pregnancy, and by 12 weeks' gestation a significant rise, averaging 12%, has already occurred.⁴

The direction of the association between maternal packed cell volume and poor pregnancy outcome needs to be determined as low haemoglobin values have been linked with subsequent raised blood pressure in childhood,⁵ which may be

a precursor of adult disease. This will be possible only by prospective follow up of women from before the start of pregnancy through to delivery, with examination of the relation between changes in plasma volume and haemoglobin concentrations and the outcome of pregnancy.

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Figure for lower end of range of maximal haemoglobin is too low

EDITOR,—The U shaped curves of low birth weight and preterm delivery by maternal haemoglobin concentration described by Philip Steer and colleagues¹ were established by Garn *et al*.² The two groups agree about the decline in reproductive efficiency when maternal haemoglobin concentration is above about 140 g/l (or packed cell volume 0.41), observations which need to be known by all obstetricians.

The two groups differ importantly, however, over what is the lower end of the range of maximal haemoglobin concentration during pregnancy. The curve of Garn *et al* showed reducing percentages of favourable pregnancies when lowest maternal packed cell volume was below 0.32 (haemoglobin concentration about 110 g/l) in white Americans or below 0.29 (haemoglobin concentration about 100 g/l) in black Americans. In contrast, Steer and colleagues reported a maximum mean birth weight and the lowest incidences of low birth weight and preterm delivery in white women with the lowest haemoglobin concentrations of 85-105 g/l.

In 83 Australian multigravidae (predominantly white women) who had not been anaemic in previous pregnancies we also found that birth weight was significantly inversely related to the haemoglobin concentration at first antenatal attendance and the lowest haemoglobin concentration recorded.³ These low concentrations were recorded in early or mid-pregnancy (the mean period of gestation at first attendance was 19 weeks and at the time of lowest haemoglobin concentration 31.1 weeks).

As the adverse effects of maternal anaemia on the fetus are rapidly reversed by successful treatment,⁴ and as even mild maternal anaemia from any cause is associated with compensatory placental hypertrophy,⁵ we postulated that high birth weight of infants whose mothers had experienced anaemia earlier in pregnancy could be explained by the persistence of large placentas after the correction of anaemia. All the haemoglobin estimations by Steer and colleagues were before half way through the third trimester. They do not say when in gestation the lowest haemoglobin concentrations occurred; if these were fairly early in pregnancy and were followed by haematinic supplementation or treatment the conclusion that haemoglobin concentrations in the range of 85-105 g/l during pregnancy are optimal cannot be accepted.

Many black women (27 241, 46% of the total) were included in the American series,² and an ethnic difference emerged that was not apparent with the small number from ethnic minority groups in the British series.¹ The range of optimal