small cannula placed in each of the anterior nares. The carbon dioxide profile was sampled continuously by a capnograph similar to that used by Bolton *et al.* The infant was, at the time of the recording, allowed to assume his own head position after being placed to sleep prone on a soft, bark filled mattress similar to the ones described by Ponsonby *et al.*² and reported to be associated with an increased relative risk of sudden infant death syndrome (SIDS). The infant's head was also completely covered with a spun polyester filled quilt, the door was closed, and the ventilation grills were taped over. These circumstances were designed to promote 'rebreathing' of expired gases. The figure illustrates the breath by breath concentration of carbon dioxide at the nose and is typical of many other investigations that we have performed.³ This section of the trace was extracted some three minutes after commencement of recording and extends for a further two minutes. It is clear that some accumulation of carbon dioxide does occur but this is at much lower concentrations than those recorded from either mechanical or mathematical models. Furthermore, and most significantly, there is no observed tendency for the carbon dioxide to continue to increase; rather a 'steady state' is reached at a new carbon dioxide concentration.

Figure 2 in their paper may afford some clue to the apparent discrepancy between the inexorable increase in carbon dioxide demonstrated by Bolton *et al.* and the low level hypercapnia which we see in real life. It can be seen from the carbon dioxide profile that in the model, end tidal as well as end inspired carbon dioxide rises. In fact they rise in parallel. The model is unphysiological in that it takes no account of the equilibration between lung carbon dioxide concentrations and mixed venous tension. The model also takes no account of body carbon dioxide stores (120 l in an adult) which are large compared to lung stores and act as a compartmentalised buffer. The model also takes no account of the extraction of oxygen from inspired air, the addition of 35 ml/min of

carbon dioxide effectively creating a net outward pressure which will alter the dynamics of gas mixing in the bedding.

The upper panel of our figure shows the carbon dioxide profile of a ventilatory response test carried out by the Read rebreathing method. In this test, modified by Cohen and Henderson-Smart for use in neonates,⁴ the baby is switched to rebreathe from a bag containing carbon dioxide enriched air. The baby's mixed venous carbon dioxide tension (PCO_2) quickly equilibrates to that of the bag and PCO_2 then rises in a linear fashion at 0.80–1.07 kPa/min, independently of ventilatory response. In this extreme case of rebreathing the oscillations in carbon dioxide are quickly lost as the baby breathes in and out, quite unlike the trace shown in the Bolton paper.

We believe that this serves to illustrate that the model is too unphysiological to draw any firm conclusions about the existence or nature of 'rebreathing' in the prone sleeping position.

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Dr Bolton and colleagues comment:

The results described by Malcolm and Henderson-Smart do not conflict with our

views. For rebreathing from bedding to occur there must be a considerable area of firm apposition, which can occur if the full weight of a baby's head is pressing face down into soft bedding. Our later investigations (in the process of publication) show that bedding over the supine model requires at least four layers of blankets to show significant rebreathing. Neither of these conditions were present in the data from Malcolm.

We do, of course, recognise that the time course of carbon dioxide levels in the airways of a rebreathing baby would differ from our model in that carbon dioxide excretion would slow considerably as alveolar levels rise to and above 7%. But this is hardly reassuring as there would be no corresponding diminution in the rate of fall of oxygen tension. The 'Read' rebreathing trace is in no way analogous to the normal physiological pattern of rebreathing as the carbon dioxide content is artificially high, cutting out the phase of carbon dioxide accumulation, as well as adding a considerable volume of gas to the system. More relevant is the time course of carbon dioxide and oxygen at the lips while rebreathing from an initially empty bag. The asphyxial change becomes intolerable in 30 to 40 seconds. This is 100% rebreathing, unlike the figure in our paper, but some bedding can mimic this closely.

Our paper was about the behaviour of some types of bedding rather than modelling the physiological behaviour of a normal baby. We would re-emphasise that a baby with a normal response to these gas changes would increase its tidal volume and achieve a degree of relief from this; it would certainly arouse, probably noisily, if the asphyxial gas levels persisted at a level of 5% carbon dioxide with a corresponding degree of hypoxia.

If a baby with immature responses to asphyxia lies face down into soft bedding, then it would be a different matter entirely. We have been able to test these responses in a 5 month baby found face down, blue and unresponsive, but successfully revived. They were inadequate then, but matured by 9 months of age.

The upper panel illustrates the continuous carbon dioxide trace when a baby is constrained to rebreathe into a bag containing 7% carbon dioxide. Note the rapid loss of large swings in the carbon dioxide signal as lung carbon dioxide concentration equilibrates with mixed venous blood. The lower panel is a trace from a normal 6 week old infant placed in a situation chosen to promote 'rebreathing'. The trace was extracted from a longer record and is taken from around three minutes into the recording. The period of the trace extends for two minutes.

Primary immunisations in Liverpool

EDITOR.—The articles by Pearson *et al.* provide a detailed picture of the immunisation of children resident in Liverpool five years ago.^{1,2} Both papers show the association between social and family circumstances, consent and completion of immunisation. The overall deprivation index was used as 'it is a more accurate index of socioeconomic conditions than the Jarman underprivileged area score'.

It is most surprising that having identified the importance of social and family circumstances in restricting immunisation uptake, neither paper refers to the widely disseminated British Market Research Bureau (BMRB) report of 1989 *The Uptake of Pre-School Immunisation in England*, nor to the change in the routine immunisation schedule. In May 1990, the timing of immunisation was accelerated in order to overcome many of the barriers to immunisation that these two papers identify. Since then uptake has risen in all health districts, including Liverpool, national 90% targets have been met, and less than 1% of health districts presently report uptake less than 80%. A 95% uptake is now reported by 137 districts for diphtheria third dose (D3) uptake at 18 months, by 59 for

Vaccine uptake, August 1993 (Source COVER returns to CDSC/PHLS)

	Jarman score	D3	P3	MMR
Liverpool	23	91	87	89
East Birmingham	25	97	95	93
Tower Hamlets	55	90	88	89
National	0	95	93	93

pertussis (P3) uptake, and by 70 for measles, mumps, and rubella (MMR) at 2 years.³

While family and social circumstances are clearly very important factors in influencing immunisation performance, the BMRB report identified the importance of the local management of the immunisation services in overcoming these impediments. In the table, the most recently available Liverpool immunisation uptake data is compared with that of a district with the closest match Jarman score, the English district with the highest Jarman score (most deprived) and the national average.

Even accepting the fallibility of the Jarman score and the lack of comparability of East Birmingham with Liverpool, there can be little doubt that Tower Hamlets is an appropriate district for comparative purposes. Immunisation uptake is as high there for pertussis and MMR, clearly indicating that local management of the immunisation programme can overcome socioeconomic barriers to immunisation.

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- 1 Pearson M, Makowiecka K, Gregg J, Woollard J, Rogers M, West C. Primary immunisations in Liverpool. I: Who withholds consent? *Arch Dis Child* 1993; **69**: 110-4.
- 2 Pearson M, Makowiecka K, Gregg J, Woollard J, Rogers M, West C. Primary immunisations in Liverpool. II: Is there a gap between consent and completion? *Arch Dis Child* 1993; **69**: 115-9.
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Professor Pearson and coauthors comment:

We thank Drs Salisbury and Begg for their interest in our paper looking at immunisation of children resident in Liverpool two years ago and not five as stated in their letter. They have drawn our attention to the BMRB report of 1989, *The Uptake of Pre-School Immunisation in England*. As it has been so widely disseminated, it is surprising that it was not referred to in any of the recent publications on immunisation.

We would agree that it was an omission not to mention the accelerated programme of vaccination. However, we could not see how that could overcome the practical or attitudinal barriers to immunisation, nor address the issue of consent.

Good local management of immunisation services is crucial, but is becoming increasingly difficult. In Liverpool, health visitors are in one trust, clinical medical officers and the immunisation coordinator in another trust, and approximately two thirds of vaccinations are done in general practice. Despite these difficulties, COVER statistics show that pertussis uptake has increased by 6%. As diphtheria has only increased by 1%, we

would suggest that good management resulting in increased confidence in pertussis accounts for the improved figures, rather than the accelerated programme.

A recently published report based on the 1991 census places Knowsley and Manchester as the most deprived districts in England, with Liverpool a very close third.¹ Tower Hamlets was ranked fifth. Perhaps Knowsley (an adjoining district to Liverpool) would be more appropriate for comparative purposes. The COVER statistics for Knowsley and St Helens Health District are diphtheria 89%, pertussis 85%.

1 *People and places - a 1991 census atlas of England*. University of Bristol, SAUS Publications.

EDITOR,—The recent articles by Pearson *et al*, about obtaining consent of parents for immunisations,^{1,2} seem to assume the moral or political necessity of the process as a precondition for immunisation. This raises the question as to the basis of this assumption. Children are not autonomous agents and require surrogate decision makers. There is a reasonable assumption that parents, under most circumstances, are most likely to be able to represent the interests of their child. This is not a universal right or law, however, and there is ample precedent for having other surrogates if the parents are neglectful, incompetent, or abusive, etc.

If the society, through its elected representatives and after intensive, objective scientific debate, determines that immunisations are beneficial and necessary for the public health and for the child, and that the individual risks associated with immunisation are small in respect to the benefits, then no reasonable caring parent should object and no unreasonable or uncaring parent should be allowed to object. The children of the minority of parents who refuse immunisation will benefit from the herd immunity resulting from all those children who face the small risk of the procedure. This is clearly inequitable and unjust. If all stand to benefit, all should share the risk.

As these articles and other studies demonstrate, considerable effort and resources that might otherwise be more beneficially employed are required to obtain and document immunisation consent. Perhaps consideration should be given to devoting those resources to improving the public's confidence in the process of reviewing the safety and effectiveness of vaccines, and to justification of a policy of mandatory immunisation without formal consent.

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Resolution of hepatic abscess after interferon gamma in chronic granulomatous disease

EDITOR,—We read with interest the report by Hague *et al* of possible benefit from interferon gamma in an acute infection in a patient with

chronic granulomatous disease.¹ Our recent experience would not support this suggestion²: a 3 year old boy with known chronic granulomatous disease presented with a left sided chest wall mass and the diagnosis of extensive intrathoracic and extrathoracic aspergillosis was confirmed by a percutaneous biopsy guided by computed tomography. He was treated initially with intravenous liposomal amphotericin and subcutaneous interferon gamma 50 µg subcutaneously three times weekly, but his clinical condition deteriorated significantly during seven weeks of treatment. Amphotericin was therefore discontinued and he was commenced on oral itraconazole suspension which resulted in progressive clinical improvement after three months on this regimen, and marked radiological clearing after eight months of treatment. The patient remains well on maintenance itraconazole suspension and subcutaneous interferon gamma three times weekly.

This suggests to us that interferon gamma did not have a major influence on the resolution of the severe fungal lung infection in this patient. A controlled trial on the use of prophylactic antimicrobial treatment is required which should include antifungal prophylaxis with itraconazole suspension. However, given the apparent success of continuous prophylactic treatment with interferon gamma,³ the suggestion that such a study should include intermittent interferon gamma treatment would be difficult to justify on ethical grounds.

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Bovine colostrum immunoglobulin concentrate for cryptosporidiosis in AIDS

EDITOR,—Shield *et al* report the case of a child with AIDS complicated by cryptosporidiosis who showed a favourable response to hyperimmune colostrum.¹ The report documents the availability of a commercially available preparation but casts no new light on the management of cryptosporidiosis affecting the immune compromised.

It has been known for many years that cryptosporidiosis may cause severe illness complicating a variety of humoral and cell mediated immune deficiency states.² There have also been a number of case reports documenting varying degrees of clinical and microbiological benefits by the administration of various forms of enteral immunotherapy to patients with diverse immune deficiency states, including AIDS, complicated by cryptosporidiosis.³⁻⁵ These include hyperimmune bovine colostrum, pooled bovine colostrum, whey protein concentrate, and human serum immunoglobulin.