LETTERS TO THE EDITOR

Respiratory rate and pneumonia in infancy

Sir,—Dr Berman et al have presented an interesting and comprehensive paper about the use of respiratory rate in infants in the diagnosis of pneumonia.1 This is an important topic because counting respiratory rate is a critical aspect of the World Health Organisa-
tion acute respiratory illness programme.

One of the difficulties has been that the normal range of respiratory rate had not previ-
ously been defined. The object of our paper
was to define the normal range of respiratory rate in infants when they were awake.
Berman et al suggested that our results (mean
(SD) 61 (18)/minute) were too high because they do not agree with studies using elec-
tronic monitoring. Unfortunately, electronic monitoring is not a satisfactory gold standard
for respiratory rate because studies in awake babies have movement artefact and the study
of sleeping babies is not appropriate for routine clinical practice. Our range of respiratory
rate for sleeping babies was similar to those in the published literature (42 (12)/
minute).

They suggest that the use of a stethoscope
or a hand on the chest for counting the respira-
tory rate in our study may have stimulated the infants to breathe faster than normal. Their
own experience with studies using electronic
monitoring is not a satisfactory gold standard
for respiratory rate 14 breaths/minute higher than that obtained by observation. This may be
possible, although it was not our observation.

We used this technique simply because we
found it very difficult to count respiratory rate
by observation and wanted to use a technique
that could easily be used in all babies regard-
less of their state. It was our experience that
respiratory rate could be counted by observa-
tion accurately in sleeping or ill babies because they lie still and often have increased respira-
tory effort. It was surprisingly difficult in
lively healthy babies because they move approx-
nately once a second and also breathe shallowly and irregularly.

Berman et al compare our data with a study
in which respiratory rate was counted by
observation in a community in Peru. Unfortu-
nately, even that data can not be considered
to represent the respiratory rate range of
normal infants because the children were selec-
ted for the study only if they had a cough.

Unfortunately, the authors make a com-
mmon statistical mistake when calculating sen-
sitivity, specificity, and predictive values
for pneumonia using respiratory rate above or
below 50 or 60 breaths/minute. Their data
were collected only from selected children
seen in hospital. In their Denver study the in-
fants were only seen if they had a cough or
congestion and in the Vellore study the infants
presented with a runny nose or cough.

The authors had no data from normal
infants. Sensitivity, specificity, and predictive values are accurate only for the populations
from which the data were derived and cannot
be applied to infants in the community. Even using this selected data the sensitivity of a respira-
tory rate of 60 or more for lower respiratory infection was only 65% in Denver and 58% in Vellore. To be a useful screening
test for pneumonia, respiratory rate measure-
ment must have a much higher sensitivity.

Before it can be claimed that respiratory rate is a useful screening test for pneumonia data
must be presented using a simple techni-
que of proved accuracy and repeatability from
children with pneumonia and normal children in the communities where it will be used.

C OLIN J MORLEY
Department of Paediatrics,
Addenbrooke's Hospital,
Level 8, Hills Road,
Cambridge CB2 2QQ


Dr Berman and Simoes comment:
We appreciate the opportunity to respond to Dr Morley's comments. The point we annota-
ted is not our primary focus. The issue of the usefulness of simple clinical signs to identify pneumonia is important and we agree that it is necessary to document the range of respiratory rate counts in infants with and without acute respiratory infections. Interpretation of studies is impaired by the use of different counting methods. Unfortunately there is no counting method that can be considered a gold standard. It is possible that differences in respiratory rates reported in studies may partially reflect the different methods used to obtain them. Our own study comparing simultaneous counts obtained by observation and electronic pneumograph tracing documents differences between these
methods.1 Our annotation pointed out that counting with a stethoscope or by placing a
hand on the abdomen may itself result in differences compared with obtaining counts by
other methods. The use of a 15 second counting interval would also increase any consistent difference by a fourfold factor. We agree with Dr Morley that respiratory rates in very active 'lively' infants is diffi-
cult regardless of the counting method. Our
recently completed study corroborates this finding.

The World Health Organisation (WHO)
chose to develop respiratory rate thresholds
based on data obtained using 60 second
observed counts. This choice was made for
operational reasons, based on the need to train
community health workers to count respira-
tory rates without using a stethoscope.

The WHO respiratory rate thresholds have
been designed to be used on subjects who have respiratory symptoms of cough or coryza.
The case management guidelines are not relevant for healthy infants and children without respiratory symptoms. It is for this reason that sensitivity, specificity, and predictive value should be calculated on populations with respiratory symptoms. The predictive value of the respiratory rate threshold for pneumonia will vary with the prevalence of the pneu-
monia in the population with respiratory
symptoms. It was not our intention to gen-
eralise sensitivity, specificity, and predictive
value to the total population of children with
and without respiratory symptoms.

We agree that the sensitivity and specificity of the WHO respiratory rate threshold applied
to infants under 2 months of age is not as good
as that in older infants and children. Further
research is needed to evaluate the usefulness
of the threshold in association with other clinical signs to diagnose pneumonia in that age
group. Studies are underway in the Gambia
and the Philippines to clarify these issues.

1 Simoes EAF, Roark R, Berman S, Esler LL, Murphy J. Respiratory rate: measurement of variability over time and accuracy at different

Diagnosis of pneumothorax by
echocardiography

Sir,—Over the last 18 months we have per-
fomed frequent echocardiograms on venti-
lated neonates as part of a study on haemo-
dynamics.2 Pneumothorax is common in this
setting. We report three cases where pneumo-
thonax was first suspected on echocardi-
ography.

Case reports

CASE 1
This infant, born at 41 weeks' gestation weighing 2370 g, was ventilated after birth asphyxia and meconium aspiration. A chest x ray picture at 4 hours showed no air leak. At 22 hours the heart was difficult to see echo-
cardiographically and was best seen from the right sternal edge. There was no clinical deterioration. Transillumination was negative. A further chest x ray picture showed a small left pneumothorax which was managed con-
servatively. Five hours later, radiography showed no air leak and echocardiographically the
heart was easily seen and normally positioned.

CASE 2
This infant, born at 25 weeks' gestation weighing 785 g, was ventilated for hyaline membrane disease. There was no air leak on a chest x ray picture at 4 hours. At 16 hours, on echocardiography, the heart was difficult to see and displaced to the right. Transcutaneous carbon dioxide had risen from 4·5 to 6·9 kPa over the previous half hour. Transillumination showed left tension pneumothorax. After drainage, the heart was no longer displaced on echocardiography.

CASE 3
This infant, born at 27 weeks' gestation weighing 1040 g, was ventilated for hyaline membrane disease and birth asphyxia. A chest x ray picture at 10 hours showed no air leak. Echocardiography at 14 and 36 hours showed poor myocardial function. From 48 to 52 hours systolic blood pressure fell from 40 mm
Hg to 32 mm Hg despite support. At 52 hours the heart was difficult to see echocardiographi-
cally but was displaced to the left with the apex tilted cranially. Transillumination showed right tension pneumothorax. After drainage the blood pressure rose to 58 mm
Hg; echocardiography showed an easily seen, normally positioned heart.

The heart is normally easy to see echo-
cardiographically in the neonate ventilated for hyaline membrane disease. In these three
cases the heart was difficult to see from the left sternal edge, and was displaced away from the air leak; this was presumably due to a combination of mediastinal shift and interpos-
ing air, which is impervious to ultrasound.

Unilateral pulmonary intersitial emphysema has mimicked these findings, hypertrophied