being compared with injection sclerotherapy.[11-14] The evidence now suggests that they should be compared with the new method of choice—band ligation.[15]

P C HAYES
Senior lecturer

Department of Medicine,
Royal Infirmary,
Edinburgh EH3 9YW

1 Lebrec D, Poynard T, Hillon P, Benhamou J-P. Propranolol for prevention of recurrent gastrointestinal bleeding in patients with cirrhosis. *N Engl J Med* 1981;**305**:1371-4.
2 Burroughs AK, Jenkins WJ, Sherlock S, Dunk A, Walt RP, Osuafor TOK, *et al.* Controlled trial of propranolol for the prevention of recurrent variceal haemorrhage in patients with cirrhosis. *N Engl J Med* 1983;**309**:1539-42.
3 Hayes PC, Davis JM, Lewis JA, Bouchier IAD. Meta-analysis of the value of propranolol in prevention of variceal haemorrhage. *Lancet* 1990;i:153-6.
4 Stiegmann GV, Goff JS, Michaletz-Onody PA, Korula J, Liebermann D, Saced ZA, *et al.* Endoscopic sclerotherapy as compared with endoscopic ligation for bleeding esophageal varices. *N Engl J Med* 1992;**326**:1527-32.
5 Laine L, El-Newihi HM, Migikovsky B, Sloane R, Garcia F. Endoscopic ligation compared with sclerotherapy for the treatment of bleeding esophageal varices. *Ann Intern Med* 1993;**119**:1-7.
6 Gimson AES, Ramage JK, Panos MZ, Hayllar K, Harrison PM, Williams R, *et al.* Randomised trial of variceal banding ligation versus injection sclerotherapy for bleeding esophageal varices. *Lancet* 1993;**342**:391-4.
7 Hou M-C, Lin H-C, Kuo BI-T, Chen C-H, Lee F-Y, Lee S-D. Comparison of endoscopic variceal injection sclerotherapy and ligation for the treatment of esophageal variceal hemorrhage: a prospective randomized trial. *Hepatology* 1995;**21**:1517-22.
8 Lo GH, Lai KH, Cheng JS, Hwu CH, Chang CF, Chang SM, *et al.* A prospective, randomized trial of sclerotherapy versus ligation in the management of bleeding esophageal varices. *Hepatology* 1995;**22**:466-71.
9 Laine L, Cook D. Endoscopic ligation compared with sclerotherapy for treatment of esophageal variceal bleeding: a meta-analysis. *Ann Intern Med* 1995;**123**:280-7.
10 Hepworth CC, Gong F, Kadirkamanathan SS, Middleton S, Brown D, Burnham WR, *et al.* Experimental and clinical studies of endoloops: a new method of mechanical haemostasis for oesophageal varices. *Gut* 1995;**37**(suppl 2):A1.
11 Sanyal AJ, Freedman AM, Purdum PP, Luketic VA, Shiffman ML, Tisnado J, *et al.* Transjugular intrahepatic portosystemic shunt (TIPS) vs sclerotherapy for prevention of recurrent variceal haemorrhage: a randomized prospective trial [abstract]. *Gastroenterology* 1994;**106**:A975.
12 Merli M, Riggio O, Capocaccia L, Ziparo V, Bolognese A, Rossi P, *et al.* Transjugular intrahepatic portosystemic shunt vs endoscopic sclerotherapy in preventing variceal rebleeding: preliminary results of a randomized controlled trial [abstract]. *Hepatology* 1994;**20**:43.
13 Rossle M, Deibert P, Haag K, Ochs A, Siegerstetter V, Langer M. TIPS versus sclerotherapy and beta-blockade: preliminary results of a randomized study in patients with recurrent variceal hemorrhage [abstract]. *Hepatology* 1994;**20**:44.
14 Cabrera J, Maynar M, Granados R, Gorriz E, Reyes R, Pulido-Duque JM, *et al.* Transjugular intrahepatic port asystemic shunt versus sclerotherapy in the elective treatment of variceal bleeding. A randomized controlled trial [abstract]. *Hepatology* 1994;**20**:425.
15 Jalan R, Forrest EH, Stanley AJ, Redhead DN, Dillon JF, Finlayson NDC, *et al.* TIPSS vs variceal band ligation for prevention of variceal rebleeding in cirrhosis: a randomised controlled study. *Gut* 1996;**38**(suppl 1):W24.

The paperless general practice

It is coming, but needs more professional input

The contract between health commissioning authorities and general practitioners states that "a doctor shall keep adequate records of the illness and treatment of his patients on forms supplied to him for the purpose." "Form" is clearly a paper form, yet in 1993 a large national survey found that 8% of general practices were already paperless.[1] The regulations will probably soon be changed to remove the limitation on paperless records. Are general practitioners and their clinical information systems ready for this legitimisation?

Certainly electronic medical records have been admissible in medical litigation and criminal cases for some years,[2] though the Civil Evidence Act requires that the computer system should be created for the purpose that it is being used; there should be proper hardware and software maintenance; electronic records should be contemporaneous; and there should be a full audit trail of additions and deletions. The required audit trails are specified in version 3 of the requirements for accreditation for general practice computer systems,[3] and most systems now conform to at least these sections. Furthermore, there is now case law of electronic medical records being used as evidence.[4] Practices also need to register under the Data Protection Act 1984.[5] The implication of all these changes is that it is (or soon will be) legal to be paperless.

What about confidentiality? This is an important issue of the moment,[6 7] and the debate about maintaining patient confidentiality needs to be concluded before paperless clinical records spread their wings across any wide area network. Nevertheless, in the "trusted base" of general practice the nine Anderson principles of data security[6] should be achievable given consideration and some changes to systems.

Of course, the paperless practice includes more than simply the medical record: it also encompasses administration and other issues relating to clinical information systems. Paperless records in their raw electronic text form add only availability and legibility to their paper form and lack paper's ability to carry figurative annotations.[8] An electronic record in coded form, however, opens the door to many forms of added value. These include automated restructuring of records (such as for problem lists); queries on data (such as for disease registers or quality assurance); decision support systems (such as PRODIGY[9]); speeding, guiding, and validating data input (such as through templates); mailmerge functions (such as for standard semi-automated referral letters); and electronic messaging (such as for laboratory results).

Nevertheless, an important part of the record will remain free text: the patient's story needs to be captured adequately to enable effective communication through medical records.[10] This requirement for recording the patient's story needs free text narrative, which is perhaps not always recorded. Of course, some data currently need to be coded as free text searches but on free text are limited. The proposed "narrative model" of the medical record[10] challenges current clinical and medical informatics views and perhaps will move us forward.

In summary, what are the pros and cons of the electronic record and the paper record? The losses are not yet clear, but where they are visible, as outlined above, they are looking tolerable. The gains improve practice, perhaps significantly, as can be seen from the two recent systematic reviews that covered clinical information systems,[11 12] which at their heart have the coded electronic medical record.

In current clinical systems the gains derive from the data entered. With little data in a system there is little gain; this has been the major barrier to progress towards paperless practice. Once a reasonable amount of data have been entered, however, the data start to work for the clinician and the patient—and this provides the incentive to learn new skills. Most general practice systems support the basics of paperless practice, but a few still do not. Technical innovation is also still required in relation to computer interfaces, though one of the greatest difficulties is reaching a professional consensus so that interfaces can be engineered with enough "intelligence" to make them quick and intuitive tools.

The major issues that need addressing are professional: the production of good practice guidelines for medical records; a review of the purpose, structure, and content of medical records; the authoring of knowledge bases to improve interfaces; and educating general practitioners about what constitutes a quality record and the best use of clinical information systems. The system suppliers also have work to do. The requirements for accreditation for general practice computer systems need a more effective set of user requirements and evaluation of developments, and these in turn need more input from the clinicians who will use these systems. The time of top down processes, led by management

consultants, should come to an end. Given enthusiasm by the clinical professions, the NHS Executive should see a gain from funding collaboration between the professions and system suppliers to develop these future systems.

So are we ready for paperless practice? The short answer has to be a cautious yes. In fact over 10% of general practices probably already are paperless. Furthermore, the quality of their records has been shown to be good.[13] The slightly longer answer is still yes, though work is needed to ensure that the computer as a tool is integrated into the consultation, and that in turn needs efforts from the professions as well as from system developers.

IAN N PURVES
Director

Sowerby Unit for Primary Care Informatics,
Department of Primary Health Care,
Newcastle University, Newcastle upon Tyne NE2 4HH

1 NHS Management Executive. *Computerisation in GP practices: 1993 survey.* London: Department of Health, 1993.
2 Norwell N. GP computer records—questions answered. *Journal of the Medical Defence Union* 1992;2:43-4.
3 NHS Management Executive. *General medical practice computer systems. Requirements for accreditation.* Version 3. Leeds: Department of Health, 1995.
4 R *v* Arun Kumar Sinha. *Times* 1994: Jul 13.
5 General Medical Services Committee. *Guidance to general medical practitioners on data protection registration.* London: GMSC, 1991.
6 Anderson RJ. Clinical system security: interim guidelines. *BMJ* 1996;312:109-11.
7 NHS Executive. *The protection and use of patient information.* London: Department of Health, 1996. (HSG (96) 18.)
8 Purves IN. The current state and future needs of the electronic medical record for primary health care: a pragmatic view for the United Kingdom. In: Teasdale S, Bradley P, eds. *Proceedings of the annual conference of the primary heath care specialist group of the British Computer Society.* London: BCS, 1993:113-22.
9 Purves IN. Guidelines for GPs are being tested. *BMJ* 1996;312:446.
10 Kay S, Purves IN. Medical records and other stories: a narratological framework. *Methods of Information in Medicine* (in press).
11 Johnston ME, Langton KB, Haynes RB, Mathieu A. The effects of computer based clinical decision support systems on clinician performance and patient outcome. A critical appraisal of research. *Ann Intern Med* 1994;120:135-42.
12 Sullivan F, Mitchell E. Has general practitioner computing made a difference to patient care? A systematic review of published reports. *BMJ* 1995;311:848-52.
13 Pringle M, Ward P, Chilvers C. Assessment of the completeness and accuracy of computer medical records in four practices committed to recording data on computer. *Br J Gen Pract* 1995;45:537-41.

Persistent tachypnoea in neonates

May indicate mild pulmonary hypoplasia

See p1149

Acute respiratory distress is common in newborn babies, and clear principles have been established for its management. The same is not true for persistent tachypnoea; in the neonatal period it is much less recognised, and advice on its recognition and management has been sparse.

Persistent tachypnoea in neonates is difficult to define. Respiratory disorders after birth are so common that persistent tachypnoea may not be recognised until after the first week of life. The upper limit for a normal respiratory rate is not clear. In one recent study of normal infants, 95% confidence intervals for respiratory rate during the neonatal period were 35 to 66 breaths a minute (range 30-76) in awake subjects and 27 to 54 (range 27-62) during sleep.[1] Thus, the upper ranges of normality are high, and detecting clinically significant tachypnoea requires clinical judgment and consideration of associated features such as grunting and soft tissue recession.

Persistent tachypnoea has a wide differential diagnosis. It includes relatively common conditions such as cystic fibrosis, recurrent aspiration, immunodeficiency, and early asthma; and less common conditions such as pulmonary hypoplasia, fibrosing alveolitis, chlamydial pneumonia, chronic lung disease of prematurity, upper airway obstruction, diaphragmatic hernia, H type tracheo-oesophageal fistula, phrenic nerve palsy, congenital heart disease, and inborn errors of metabolism.

When examining an infant, a doctor should carefully assess the respiratory rate, preferably counted over 60 seconds during sleep. Grunting suggests important respiratory distress, while wheezing suggests either fixed or variable airway obstruction. Inspiratory stridor is consistent with extrathoracic airway obstruction, and expiratory stridor is consistent with intrathoracic obstruction. A weak cry may signify abnormalities in the vocal cords. The doctor should observe the chest wall for deformity, hyperinflation, and asymmetry of movement. Asymmetrical breath sounds may indicate unilateral pulmonary hypoplasia, and crackles indicate fibrosing alveolitis. The doctor should also examine the cardiovascular system.

Appropriate investigation depends on the clinical findings, but transcutaneous oximetry and a chest *x* ray are essential. The chest *x* ray picture will help in making the diagnosis in most, though not all, cases.[2] In the absence of specific clues further investigation should include an electrocardiogram and an echocardiogram to detect a possible occult cardiac cause. Sweat test, barium swallow, immunoglobulin assay, arterial blood gas measurement, metabolic screen, pulmonary function tests, bronchoscopy, and lung biopsy should also be considered, depending on the individual case. Treatment will depend on the diagnosis.

In this issue of the *BMJ* Aiton *et al* raise the possibility that primary pulmonary hypoplasia might be more common than was previously thought (p1149).[2] They present the cases of four neonates in whom mild pulmonary hypoplasia was missed despite persistent tachypnoea. There are few data to determine how often pulmonary hypoplasia occurs. Most reported cases are secondary to other abnormalities, particularly oligohydramnios, chest wall or diaphragm abnormalities, lung malformations, or prematurity.[3 4]

So, how reasonable is the proposition that milder cases of primary pulmonary hypoplasia might be missed? The crucial element of the diagnosis of pulmonary hypoplasia is that one or both lungs are abnormally small.[3 4] The size that is relevant here relates to tissue mass,[3] as lung volume might not reflect the mass or degree of development of the lung tissue. This is because the volume of a given lung will vary greatly depending on inflation pressure and can be affected by pathological conditions—for example, being decreased by surfactant deficiency or airway obstruction and increased by small airways disease. The need to relate the diagnosis to tissue mass makes the diagnosis of mild cases particularly difficult. Severe cases can be detected by clinical observation or by chest *x* ray, particularly if the condition is unilateral.[5] Aiton *et al* used the measurement of lung volume to assist in diagnosing their milder cases.[2] Given the influence of other factors on lung volume, basing the diagnosis on this measurement alone would be unwise. Measurement of lung volume can be unreliable (whether by whole body plethysmography[6] or by helium dilution[7]), especially in the presence of airways disease.[8] Thus, in each individual case the diagnosis should take account of all relevant clinical information.

Mild pulmonary hypoplasia may indeed be common and frequently missed. In the short term this may not be especially important as there is no specific treatment for hypoplastic lungs and, despite anecdotal reports,[9] no treatment is known to improve lung growth. Many cases will improve with time, as