prime advantage of such a scheme is that a united infant care service is given to patients and much reduplication of work is avoided. They find that the closer liaison with the county medical officer helps greatly in placing backward children in suitable educational establishments. The local health authority doctor considers that an important result of this scheme has been the increased mutual understanding between herself and the general practitioners. Furthermore, parental interest has been high and non-attendance low.

Though it is too early as yet to make any valid statistical assessment of this pilot scheme both the local health authority doctor and the general practitioners are most anxious to continue with this arrangement. Since this scheme was started doctors in a neighbouring group practice have asked for the same local health authority doctor to be attached to their practice in a similar manner, and this second attachment began in July.

Discussion

It is important for a local health authority to keep under continual review the manner in which staff are used. This is particularly true in relation to medical staff, as their recruitment is becoming increasingly difficult. In addition, with the

proposed changes in the National Health Service structure the role to be taken by doctors who have a special interest in preventive medicine, and considerable experience of this in relation to child development and allied problems (such as special educational provision for handicapped children) must be considered.

This scheme seems to point the way to a partnership of local health authority doctors and general practitioners. In such a partnership there should be a full understanding and appreciation of the role each has in relation to his or her particular interest and experience. That such a liaison should entail true professional co-operation should hardly need mention. In this way the health services should be able to develop along the lines suggested in the recent Green Paper, making full use of the limited resources of medical manpower available in Britain and at the same time providing the best possible service to this and future generations.

We should like to express our appreciation to Dr. I. A. MacDougall, county medical officer for Hampshire, for his interest in this scheme and for his advice in the preparation of this article. We should also like to thank Dr. A. G. Turner and his partners and Miss H. W. Arnold, without whose interest and co-operation this scheme would not have been possible.

NEW APPLIANCES

Radio and Telephone System for Multiple Channel Transmission of E.C.G.s

Dr. PETER W. MACFARLANE and Professor T. D. V. LAWRIE, University Department of Medical Cardiology, Royal Infirmary, Glasgow C.4, write: Use of telephone lines for the transmission of E.C.G.s was first made by Einthoven in the early 1900s (Caceres, 1965). The actual telephone wires were used simply as long connexions between the patient electrodes and the galvanometer of the electrocardiograph. More recently, commercial equipment has become available in the United States for both single- and multiple-channel telephone transmission of biomedical signals by use of a completely different technique. In this method the E.C.G. is used to modulate an audio-frequency which itself is transmitted normally through the telephone system. In Britain a system for telephone transmission of a single-channel E.C.G. has recently been described (Colbeck *et al.*, 1968).

This preliminary communication outlines a combined radio and telephone system for simultaneous transmission of three channels of E.C.G. data, either one lead from each of three patients in a coronary care area, for example, or a three-orthogonal lead E.C.G. from one patient.

Most E.C.G. transmission systems in operation require a telephone to be placed at the bedside, and the electrocardiograph used in conjunction has a unit into which a telephone handset is placed. This suffers from the disadvantage in a large general hospital of either having a telephone facility at each bed station or a long telephone cable stretching the length of the ward. It was therefore decided that it would be more suitable to incorporate a radio link between the electrocardiograph (at the bedside) and the transmitting telephone. This is illustrated in Fig. 1, which shows the general outline of the system.

The battery-operated radio transmitter has three inputs into which the E.C.G. sig-

FIG. 1.—Schema of radio and telephone transmission system. (a) Equipment to encode and transmit E.C.G. signals. (b) Equipment which receives and decodes signals.

FIG. 2.—Three-lead E.C.G. (a) recorded at bedside, (b) received at computer laboratory. Signals were recorded on tape recorders with frequency response of 0–625 Hz and each was replayed on to the same Mingograf 34B ink jet recorder with equivalent frequency response. Illustrations show four 0.5-mV calibrations which were also transmitted, with an interchannel time separation.

nals are fed. Each signal is used to modulate the output of a voltage-controlled oscillator of unique centre frequency. The outputs of the voltage-controlled oscillators are summed and the single resultant signal is transmitted at a frequency of 102.2 MHz to a receiver up to 30 yards (27.4 m.) away or further, depending on the number of intervening walls. At this juncture the incoming signal is converted to an audio signal and transmitted by telephone to the computer laboratory. At the receiving end the transmitted acoustic signal is fed to a

series of band-pass filters which separate out each of the original voltage-controlled oscillator signals. These in turn are demodulated to obtain the initial input signals.

The centre frequencies used for the three channels are 1,250, 1,625, 2,000 Hz. Each can be deviated by ± 100 Hz. This has meant that the best results are obtained with an overall system frequency response of 0–35 Hz—that is, the frequency response is 3 db down at 35 Hz. This gives a modulation ratio (maximum deviation/maximum

frequency of interest=100/35) of approximately three, which is the lowest normally regarded as satisfactory. The overall system noise is of the order of 1%. These characteristics have been found to be adequate for transmission of E.C.G. signals (Fig. 2).

The technique has been developed to relay three E.C.G. leads simultaneously to a computer for interpretation (Lawrie and Macfarlane, 1968). The method used in this analysis does not involve a search for high-frequency notching of the E.C.G. signal,

and the frequency response of the telephone transmission system is therefore satisfactory. While it has been developed particularly for E.C.G. transmission, it could be used with other data from situations where telephones are not immediately accessible—for example, operating-theatres—since the encoding package (radio transmitter) which is attached to the data acquisition units such as E.C.G. amplifiers measures only 6 by 3 by 1 in. (15.2 by 7.6 by 2.5 cm.), and could be smaller if required. The frequency content of the data being transmitted, how-

ever, would also have to be reconsidered in each case.

We gratefully acknowledge the assistance of Dynatel Data Systems, Feltham, who designed and built the system described.

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Nomogram for Calculating Mass of Alcohol in Different Beverages

The mass of absolute alcohol is given by the point of intersection with the middle scale of a straight line joining volume and beverage

Nomogram for calculating mass of alcohol in different beverages.

Dr. C. S. MELLOR, Lecturer in Psychiatry, University of Manchester, writes: This nomogram was devised to provide a rapid means of calculating the mass of alcohol in different measures of various alcoholic beverages. The need for such a device arose out of difficulties in making comparisons between alcoholics by their alcohol consumption.

A number of methods are used to express the concentration of alcohol in alcoholic drinks. There are degrees of proof—U.K. and U.S.A.—alcohol percentage by volume

and by weight, and many more esoteric measures.

The use of volumes to express concentration is complicated because alcohol has a specific gravity of 787 and is soluble in water. As the concentration of alcohol in blood is now expressed in terms of mg./100 ml., it would seem preferable to give the amount of alcohol consumed in grammes of absolute alcohol.

The amount of alcohol in similar types of drink varies. The values given in this nomogram are the median values for each

category of alcoholic beverage. When a subject has a predilection for a specific drink it should be entered at the appropriate point on the scale for its concentration of alcohol.

There appears to be considerable local variation in the alcohol content of beer, and the Consumers' Association (1967) reports that the specific gravities of 18 out of the 44 beers they examined in 1960 were lower seven years later.

The values for draught beer are taken from Serjeant (1964) and for bottled beers and cider from the *Bottler's Year Book* (1967). The median values for wines, which also vary considerably in their concentration, are those given by Lichine and Fifield (1967). Spirits are almost always sold at 70% proof in the United Kingdom.

A variety of measures are used to sell alcoholic drinks. Spirits, sherry, and port are usually sold in bottles of 26½ fl. oz. (757.5 ml.) capacity. Rhenish wine is sold in a 700-ml. bottle, French wine in a 750-ml. bottle, and champagne in an 800-ml. bottle. For the purpose of the nomogram it has been assumed that the average wineglass contains 4 fl. oz. (114 ml.). The measures used in selling spirits are governed by the Weights and Measures Act 1963, and the amount sold must be one-quarter, one-fifth, or one-sixth of a gill (1 gill = 142 ml.) or multiples thereof.

I am grateful to Miss J. Perry and Mr. G. Briggs, of the department of medical illustration, Crumpsall Hospital, for their help in redrawing the nomogram for publication.

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