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FACTORS AFFECTING THE EFFICIENCY OF EEG LABORATORIES OF VARYING SIZES

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Efficiency cannot be measured in terms of quantity of work per dollar spent alone, for without quality you have no efficiency. Thus, it is the quantity of quality work per dollar spent that we will be referring to in our discussion of efficiency.

The factors affecting the efficiency of EEG laboratories, regardless of size, can be divided into eight major categories:

1. basic training of technician
2. physical set-up of laboratory (including equipment)
3. laboratory budget (which is, at least to some extent, a reflection of the administrative outlook)
4. technician-electroencephalographer rapport
5. patient type and age
6. technician's experience
7. advanced training of technician
8. work load of laboratory

The basic training the technician receives is critical. At the February 1964 Conference on Training of EEG Technicians sponsored by the United States Public Health Service, The American EEG Society, and The American Society of Electroencephalographic Technicians, the majority opinion was that a one year training program was needed to adequately cover the necessary material. At that time, and at the meetings of the newly formed American Board of Registration of Electroencephalographic Technologists, it was generally agreed that a very broad spectrum needed to be covered at a para-medical level, including: basics of biology (including neurophysiology and neuroanatomy), clinical neurology and clinical medicine, adult and child psychiatry, psychology, neurosurgery, interviewing, history-taking and the management of patients, neuropathology, and neuroradiology. Ideally this material should be presented in terms of the role of the EEG technician in relation to various clinical problems.

The location and physical set-up of the laboratory are of utmost importance. The laboratory must be in a generally quiet area, free of extraneous and distracting traffic and activities. There is a definite advantage in even having the patient in a separate room from the EEG machine. In addition, the laboratory must not be located near any known trouble-giving spots such as X-ray, elevators, or any large transformers. The space utilized for EEG

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recordings should, preferably, be a permanent space, and one that is not used for other purposes. I have already mentioned the advisability of having separate rooms for the patient and machine, these to be arranged so that constant observation of the patient by the technician is possible. In addition to the permanent patient bed in the laboratory (a regular hospital bed is far from ideal for EEG purposes), there need be space to bring in a hospital bed or stretcher when the patient is too ill to be moved onto the EEG bed.

The basic equipment of the laboratory, like the basic training of the technician, must be complete. In addition to the eight channel EEG machine, air conditioning, patient bed, and miscellaneous supplies, there should be properly mounted photic stimulation equipment, a reliable voltmeter and ohmmeter, a soldering iron, and a clock. Ideally, suctioning and oxygen equipment should also be available. In laboratories using EEG equipment containing vacuum tubes, a tube tester is a blessing if the results are properly interpreted.

Almost every EEG laboratory has need for at least some sleep recordings. Therefore, some arrangement is necessary so that sedation is available. The sedation must be administered only upon order of a medical doctor, of course, and thus some permanent and immediately accessible liaison between the EEG technician and a medical member of the laboratory or hospital is mandatory. This liaison is also necessary if special techniques such as carotid body stimulation, ocular pressure, Metrazol activation, or sphenoidal electrodes are to be employed.

The budget of the laboratory will greatly affect the efficiency of the laboratory. If there are inadequate supplies and machine maintenance, the recordings will suffer in quality as surely as they will suffer from an inadequate technician. EEG cannot thrive in an atmosphere where it is considered to be other than the speciality it is — a speciality requiring machinery and personnel of top performing quality.

Technician-electroencephalographer rapport cannot be stressed too highly; this rapport constitutes the backbone of the EEG laboratory. It is conceded that the technician forms the most important link between the patient and the interpreter. The technician must anticipate the electroencephalographer's wishes if the most information is to be obtained from the electroencephalogram. Also, the best of technicians will drift in technique if left unsupervised and hence the interpreter should take an active interest in the functioning of the laboratory. It is of decided value for the technician to be present when the tracings are read.

The patient load that one can expect to handle in any given time is dependent upon a number of factors: whether the patients are in-patients and readily obtainable or out-patients with specified appointments, the age of the patients, the type of disorder, the type of tracing required, the technician's ability to handle patients of varying ages and disorders, the reliability of the EEG machine, and whether the technician has any extraneous responsibilities such as typing, filing, etc.

As mentioned above, the technician's ability to handle various patient types and ages will be reflected in how many patients she can handle, but of
more importance is that this ability or lack of ability will be reflected in how meaningful a tracing the technician will produce. It does no good to say that a technician in a particular laboratory will encounter patients of only a certain type, because although all the patients may have one thing in common, such as alcoholism or mental retardation, they will often have other problems as well. Thus, we are faced with the technician needing experience in both the handling of the patient at the clinical level and at the EEG recording level. To obtain and then reap the benefits of this experience, the technician needs to be assigned to the EEG field full-time. To emphasize this point, I quote from the Conference on Training of EEG Technicians: “It was noted that there have been tendencies to lump various medical technical duties and assign them to one person, which leads to the impossible situation of an individual being responsible for running EKGs, serving as an X-ray technician, doing general hospital chemistry lab work and also running EEGs. In some cases general hospital lab personnel may be given brief EEG training and then assigned part-time, or even primarily, to EEG work, without further training. It was the panel’s opinion that technicians must be given extensive specialized training in EEG and assigned to the EEG field full-time. It was also felt that, where appropriate (as in Civil Service and military positions) an adequately defined position of ‘EEG Technologist’ should be established.”

Advanced training of the technician refers here to nothing more than covering the basic material in depth and in light of the experience gained since the initial training period. Not all technicians drift with ease into this phase of learning, but those technicians who do and who show an interest in keeping abreast of the latest techniques and information will be better able to efficiently function alone, or at least with minimal supervision.

We can now look at how these various categories can be grouped to establish efficient EEG laboratories of varying sizes.

In the larger laboratory where a number of full-time technicians are employed, the most practical arrangement is to have one supervising technician of superior quality who is directly responsible to the electroencephalographer for the technical quality of the entire laboratory.

In this situation, technicians at various stages of learning can be utilized. This is not only a great financial saving, but it also allows for the utilization of technicians who could not otherwise be employed.

The small laboratory of only one technician has no such leeway, however. To get quality for their dollar spent, the small laboratory must have only the best of technicians. Unfortunately, even the best of basic training is worthless unless the technician has the opportunity to run large numbers of records. At present, to be eligible to take Part 1 of the examination given by the American Board of Registration of Electroencephalographic Technologists it is necessary to have a minimum of three years (including the training period) of full-time (or equivalent) experience as a clinical EEG Technologist, and to have personally run at least two thousand clinical EEGs. This is an average of 55 patients a month, every month for three years!

We can now, perhaps a bit more objectively, look at the problem of the laboratory that runs only a few patients per week or even per month. This
type of set-up is extremely expensive to run: first, because of the large initial outlay of money for the necessary equipment; second, because of the high salary necessary to obtain a top-notch technician; third, because neither the equipment nor the technician is being used to anywhere near their maximal capabilities. Here is where the other half of efficiency, quantity, come into play.

Probably the best solution for the small laboratory is to contact other small laboratories in the vicinity and make arrangements to share a technician. This way the technician sees the quantity of records necessary to keep up her quality, and the laboratories working together receive the most for the salary paid out. This does not answer the problem of less than full-time machine usage, however. If the laboratory or laboratories in question cannot clearly see a sufficient increase in work volume so that there will be full-time usage of the machine, it might be wise to consider the use of high caliber portable electroencephalographic equipment. This portable equipment, like the technician, could be shared by a group of small laboratories. Such a working arrangement is quite feasible, but it calls for an even greater technician-electroencephalographer rapport if more than one interpreter is involved.

To sum up, then, we can say that efficiency is a matter of both quantity and quality, and in the EEG laboratory is dependent upon using the technician and equipment at maximum quality producing level. The large laboratory is naturally the more efficient laboratory, but smaller laboratories can collaborate to produce an artificial large laboratory, and hence gain efficiency. Having an EEG technician perform various medical technical duties is false economy.