Organization of Radiation Medicine*

DR. G. GOMEZ-CRESPO, M. D.
WHO Regional Adviser
Radiation and Isotopes

Castigat ridendo mores "Radiation medicine comprises three distinct branches: diagnostic radiology, radiotherapy and nuclear medicine. These three branches have become separate and distinct specialties in medicine but are linked together under the term radiation medicine because they have various features in common. They make use of the different properties of ionizing radiations; there are certains hazards which need the same principles of protection and call for the same basic training in the use and hazards of ionizing radiation; they need purpose built accommodation which has some features in common; they need the expert services of specially trained physicists and of technicians whose training has some common features".

"Diagnostic radiology has become the most important and expensive single method of clinical diagnosis which is available in modern medicine and it is used in elucidating the problems which arise in almost every discipline."

The Report of a WHO Seminar on the Use of Medical Radiological Apparatus and Facilities adequately covers all aspects of diagnostic radiology; methods and techniques, place of radiodiagnosis in medical care, scope for development, equipment, premises, maintenance, radiation protection and personnel.

"Radiotherapy has now become one of the most important methods of treating cancer. It is used both as a curative and as a palliative method and takes its place alongside surgery in this regard. Its efficient practice needs the service of trained radiotherapists working full-time in the specialty and not in combination with diagnostic radiology. It needs an extensive organization with expensive apparatus,

(*) A good part of the material for this paper (pages 1-4) has been "abstracted" from 2 recent lectures delivered by Sir Brian Windeyer, Vice-Chancellor, University of London, at the Group Meeting on Cancer Control, Baghdad, 27 November — 1 December 1971.

specially designed accommodation and minimal team of radiotherapist, physicist and technician."

"The justification for developing any radiotherapy service is that there is a service for cancer control and if a cancer control service is started then radiotherapy is an essential element. There is a minimal size for a viable radiotherapy department and this is one which has the capacity to treat about 500 new cancer cases per year. It will need the full-time services of one trained radiotherapist and two or three trained technicians. It may not be necessary to have the full-time services of a specially trained physicist but there must be part-time advice from such an individual on a regular basis. The minimal department needs are at least one kilocurie unit of Co-60 and one superficial X-ray therapy machine as well as an appropriate stock of needles and tubes of Co-60 or Cs-137 for intra cavitary, interstitial and short distance surface applications."

The WHO Technical Report Series Nº 328 "Planning of Radiotherapy Facilities" describes in detail the organization of radiotherapy in relation to other hospital services, staff requirements, choice of radiotherapy equipment, radioisotope services in relation to radiotherapy, accommodation and building layout for a radiotherapy department and protection.

"Nuclear Medicine is the newcomer to the radiation medicine field. It is the use of unsealed sources of radio-nuclides and has made a great impact on diagnostic procedures. The therapeutic use of nuclear medicine has been relatively limited but the diagnostic value has been great. The determination of the thyroid uptake of radioactive iodine remains the most widely used radio-nuclide diagnostic procedure. Scintigraphy is of increasing value as a diagnostic method in its own right and as confirmatory evidence to diagnostic radiological examinations. By this means the diagnosis of skeletal metastases can be made, perhaps months before they can be detected by diagnostic radiology; the localization of brain tumours can be confirmed with accuracy, and the presence and position of liver metastases can be visualized. Functional studies of the kidney may be of importance in cases of cancer involving the bladder or uterus. In Vitro tests are valuable in examination of blood diseases, thyroid activity, electrolyte disturbance and the presence of hormones in abnormal concentrations in the blood. They are of importance in general medicine and in the general management of the cancer patient."

"Nuclear medicine also needs trained personnel, and special facilities of equipment and accommodation if accurate results are to be obtained and safety standards maintained."

"In general nuclear medicine needs the backing of an efficient general medical organization and should be concentrated in the larger centres."

"All three branches of radiation medicine need adequate organization for radiological protection. This entails training of staff in the problems involved, appropriate instrumentation for monitoring of personnel and the environment and a rigid discipline if accidents are to be avoided."

"In the training of technicians for radiation medicine there is an initial basic common stem but there are marked differences in the detailed training necessary for radiotherapy and for diagnostic radiology. The training requirements for technicians

working in radiotherapy are more closely allied to those for nuclear medicine and radiotherapy technicians with little further instruction may make admirable technicians in nuclear medicine."

"There is a shortage of trained personnel, in almost all countries of the world, for all levels and all the branches of radiation medicine and this shortage may be the limiting factor in the desirable more widespread development of medical radiation facilities. It is therefore necessary to pay particular attention to all the problems involved from recruitment, to training requirements and facilities, the supply of teachers and the conditions of employment with proper status and salaries on their return from abroad. Full-time employment is necessary if they are to be retained against fierce competition caused by a worldwide shortage of trained personnel."

"In developing countries the shortage of recruits is very difficult to overcome because of the necessary demands from other disciplines. **Diagnostic radiology** should have high priority in all circumstances and radiotherapy is necessary if a cancer control scheme is to be developed. Priority for the development of nuclear medicine should be related to the development of other specialities in medicine."

"The training of technicians should be in part theoretical but mainly in-service practical work. They should spend a period of two years in training before appointment to the staff of a department. Again certification of competence is desirable."

"In countries with well-developed medical services these various training courses are established and provide no particular problem but in some countries training facilities may be difficult. The organization of regional training schools for technicians may go a long way to solving the initial problems." They have the advantage of offering more familiar surroundings to the fellows and a way of testing their capacity for their future jobs, and preparing them in basic sciences and foreign languages to a level which would make them acceptable to schools of internationally recognized standards.

It is impossible to make a generally valid estimate of the time required for training full-fledged technicians, given the considerable variations in the background of the students who can be made available or apply for this type of job. There are countries where secondary school graduates are easily available. Unfortunately in other countries only those who failed their intermediate examination, with less than three years' secondary education — would accept training for jobs like X-ray technicians for if they had succeeded in their intermediate examination they would have been eligible to continue their secondary education and eventually to enter University.

This leaves only drop-outs as potential candidates. It is very easy to imagine the impact on their final quality as technicians and the limitations imposed by such a low educational background to undertake studies on nuclear medicine or radiotherapy techniques.

Another modality of selections of students to enter technical careers which leads to instability and dissatisfaction consists of selecting those with top marks to enter engineering or medical schools and those with lower marks to take jobs as technicians. The ranks of the latter are full of unhappy people who jump at the first opportunity of entering medical school, thereby depleting the technical ranks and wasting much of the effort spent on their training.

For the organization of radiation medicine services, we invariably recommend to Governments and Institutions the following course of action:

1) To recruit a competent consultant (radiologist, radiotherapist, nuclear medicine specialist, radiological physicist) to assist:

a. in the **selection of personnel** to be trained, perhaps abroad, for a period of several years. The prospective candidates **should be interviewed** not only to check their scientific background and proficiency in the language of the countries where they are to be trained, but to ascertain their motivation for the job they are choosing — or perhaps have been chosen to do. It is extremely difficult to judge the fellows purely on the basis of their applications. A lot of disappointments and unnecessary expense would be avoided by a careful preselection followed by a serious preliminary interview.
b. in the **choice of equipment.**
c. in the **design of the premises.**

2) The design and construction of the premises should start approximately at the same time as fellows are selected and sent abroad for training.

3) Although equipment can tentatively be chosen, the order for it should not be placed until there is a reasonable assurance that the premises and auxiliary installations (plumbing, electricity, air conditioning, etc.) will be completed before its delivery. Radioactive teletherapy sources should only be delivered when the corresponding units are installed and ready for testing.

The adequate timing of all these steps is of the utmost importance, (see PERT network).

Now I am going to tell you, confidentially, how a radiotherapy department is organized in this part of the world... and perhaps in many others.

1) First "they" purchase the most expensive and sophisticated megavoltage teletherapy machine that money can buy. No sooner have the headlines of the newspapers or the television images of the fancy status-symbol megavoltage unit faded away, than the crates are stored, or rather abandoned, in a court-yard so that they can get a nice sun-tan.

2) A few years later (as many as seven in one case I recall) "they" start thinking that something has to be done about it. Credits are obtained and a huge building grows around the teletherapy unit. A magnificent building, which resembles more a place of worship than a functionally designed radiotherapy department. It is soon discovered that such a building does not meet the most elementary technical requirements and it is decided to tear it down. In the process of doing so the fancy teletherapy unit is simply wrecked.

3) After long and painful efforts a new functional building is erected but money to repair the megavoltage unit is hard to find. The building is finished, and the unit installed; someone even thinks of hanging a temporary cable connected to the electrical mains, but there is no water supply or any plan for installing it in the near future. Heating or air conditioning never finds a place in the now tight budget of the money-lenders. One has to forego these "commodities".

4) Once all these problems have been overcome, "they" look at each other only to find out with dismay that there is not a single radiotherapist available to operate

this complex and expensive equipment. Only at this stage is it decided to send a doctor to England who, hopefully, will return to the country in two or three years. Assuming that everything goes alright, the newly appointed radiotherapist finds himself upon return in a huge place crowded with obsolete equipment which he did not order, in a poor state of repair and without a single technician to operate it. It is only at this stage that the absence of qualified technicians appears to be the main obstacle to the operation of a department, the opening of which was perhaps announced with great fanfare. It is only then that it becomes imperative to send a couple of fellows abroad, for another two years, to learn radiotherapy techniques and perhaps radiological physics. Nobody thinks about the obscure repair-man or about training a good secretary, let alone budgetting the money to pay for them.

Thanks to the concerted efforts of bilateral and international agencies and to the thirst for prestige of various institutions, I estimate that about 3/4 of a million dollars worth of cobalt teletherapy units lie abandoned in different places of the Eastern Mediterranean Region. If I were to include all nuclear medicine and other scientific equipment and supplies, provided by bilateral or international agencies this sum would certainly reach several millions.

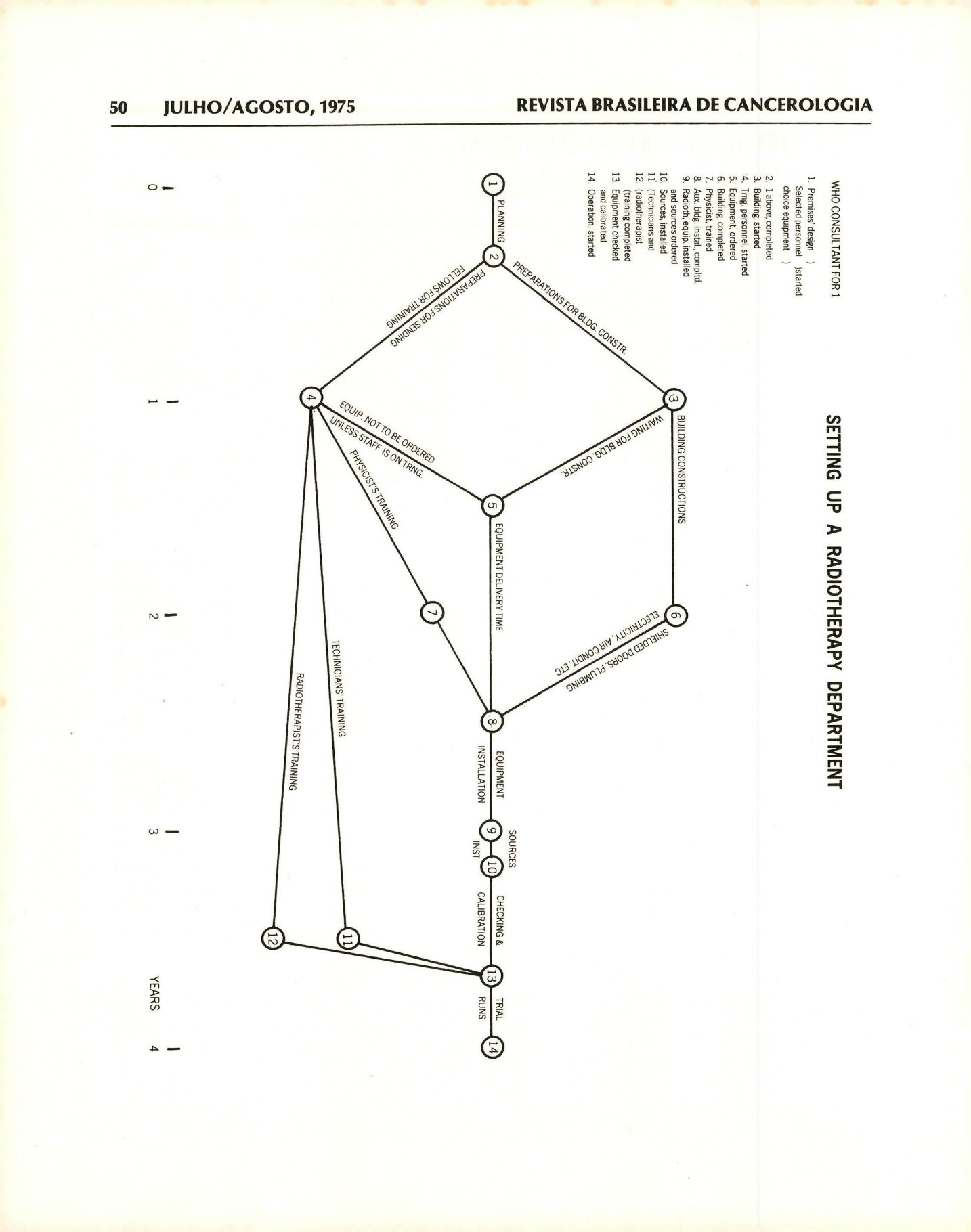
There is, however, a much more serious problem which is hampering the efficient use and the desirable development of hospital-based radiation medicine, i.e the part-time employment of personnel and use of facilities.

Unless the Governments and the various institutions realize that highly qualified professional people are forced to earn or supplement their income by working outside the hospitals, unless they realize that a considerable capital investment lies idle for too long a time and that hospitalized patients cannot receive all the attention they deserve, radiation medicine in developing countries will never reach the level of those countries where full-time employment and a day-long working schedule are the rule in all Government and University Hospitals.

It is certainly not for want of adequate schemes that our expectations in developing radiation medicine programmes are not fulfilled.

The failures are due to antimely implementation or to olympic ignorance of well-known plans. This is why I strongly feel that it is not enough for us to make sound technical recommendations.

We should also endeavour to persuade those who have the power to implement them to act in a way which is solely inspired by the best interests of their own institutions.


SETTING UP A RADIOTHERAPY DEPARTMENT
WHO CONSULTANT FOR 1
1. Premises' design) Started
Selected personnel)
choice equipment)
2. 1 above, completed
3. Building, started
4. Trng. personnel, started
5. Equipment, ordered
6. Building, completed
7. Physicist, trained
8. Aux. bldg. instal., complttd.
9. Radioth. equip. installed
and sources ordered
10. Sources, installed
11. (Technicians and
12. radiotherapist
(training completed
13. Equipment checked
and calibrated
14. Operation, started
1 PLANNING
2 PREPARATIONS FOR BLDG. CONSTR.
PREPARATIONS FOR SENDING FELLOWS FOR TRAINING
3 BUILDING CONSTRUCTIONS
4
EQUIP. NOT TO BE ORDERED UNLESS STAFF IS ON TRNG.
WAITING FOR BLDG. CONSTR.
5 EQUIPMENT DELIVERY TIME
6 SHIELDED DOORS, PLUMBING ELECTRICITY, AIR CONDIT. ETC
7 PHYSICIST'S TRAINING
8 EQUIPMENT INSTALLATION
9 SOURCES INST
10 CHECKING & CALIBRATION
11 TECHNICIANS' TRAINING
12 RADIOTHERAPIST'S TRAINING
13 TRIAL RUNS
14
0
1
2
3
4
YEARS