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RADIATION MEDICINE IN PUBLIC HEALTH

1. INTRODUCTION

The aim of this document is to analyse the situation with regard to radiation medicine in countries or areas of the Western Pacific Region and to outline areas for improvement.

Radiation medicine includes: radiodiagnosis, radiotherapy, nuclear medicine and radiation protection, each branch being essential for a fully established and self-sufficient national health care system.

In formulating strategies for health for all by the year 2000 it is obvious that primary health care will be meaningless without "health system support which includes the referral of patients to local and more specialized health institutions". Radiation medicine services are an essential part of such a referral system, starting from the primary health care level and ending in the most complex central health institutions. Comprehensive planning of such services should therefore be a relevant operation in building up the complex of support services which will be necessary for achievement of the goal "Health for all by the year 2000".

2. ANALYSIS OF THE SITUATION IN ALL WESTERN PACIFIC  
COUNTRIES OR AREAS

Despite the incomplete quantitative information available, the situation in the Region may be described as follows:

2.1 Radiodiagnosis

The range of coverage of the population varies from one machine for less than 2000 population in one country to one machine per 200 000 to 500 000 population in others. Nevertheless, most countries in the

Western Pacific Region have an acceptable coverage of one X-ray machine per 30 000 to 50 000 population. However the number of personnel available for operating the machines is not acceptable. There is a shortage of diagnostic radiologists and medical radiology technicians in most countries or areas of the Region.

## 2.2 Radiotherapy

The picture is different for radiotherapy. Only nine out of seventeen countries or areas have radiotherapeutic services and the real coverage of the population is not known.

## 2.3 Nuclear medicine

It seems reasonable to estimate that only four countries are able to meet the needs of the population for such services and four others have such services available only at the central level of their health care systems.

## 2.4 Radiation protection

Eight countries or areas in the Western Pacific Region have already started this activity and a few others are at various stages in preparing to establish a national radiation protection service.

The analysis given above stresses the need to give further consideration to setting up radiation medicine services when country health programming is undertaken. An outline for planning such activities follows:

### 3. PLANNING FOR BETTER COVERAGE AND UTILIZATION OF RADIATION MEDICINE SERVICES

As pointed out in the situational analysis, countries or areas of the Western Pacific Region are confronted with problems related to poor coverage of the population by radiodiagnostic, radiotherapeutic and nuclear medicine services; lack of specialized personnel and of possibilities for training such personnel; and inadequate utilization of existing facilities, which is related to various factors, one of the most essential being the inadequate planning of radiation medicine services. Recognising those factors is essential and an attempt is made here to outline a comprehensive plan for a radiation medicine service at the national level which can be adapted to the particular needs of the Region.

#### 3.1 Radiodiagnosis

Three levels are recognised in the hierarchy of radiodiagnostic services:

- (1) Basic radiological service, representing the lowest level of the radiological services and envisaged as a solution for better coverage of the population in countries where coverage is inadequate. A detailed description of such a basic radiological service concept is given later;
- (2) General purpose radiological service, representing the intermediate level of radiological services, able to carry out most radiodiagnostic procedures;
- (3) Specialized radiological service, representing the central and most specialized level of radiodiagnosis.

This structure of radiodiagnostic services will prevent duplication of functions, personnel, equipment, etc. and allow services with a rational cost/benefit and risk/benefit ratio to be developed.

### 3.1.1 Basic radiological service

An analysis of radiodiagnostic procedures in daily practice has shown that almost 70% could be performed with an X-ray machine designed to produce only radiographs. Consequently, most existing radiodiagnostic departments, equipped with complex machines, which can perform fluoroscopy and radiography, are "under-used" in terms of their technical potential, and "over-used" in direct physical terms, producing diagnostic information which could be obtained at lower capital and running cost. Hence, the idea of a simple unit for basic radiological services has arisen.

The basic radiological service is the smallest radiodiagnostic unit, meant to be located in health centres or small hospitals in rural, semi-urban or urban areas. It gives the benefit of radiodiagnosis to patients referred from primary health care stations. Depending on the population density and the country's resources, a basic radiological service can serve 10 000 to 50 000 or even 100 000 people. It is essentially a single X-ray machine, specially designed for such a purpose, which produces only radiographs and can be operated by a person who needs a shorter training than a fully-fledged medical radiological technician. The basic radiological service needs three rooms (one X-ray room, one dark-room and a storage/office room), sharing a waiting room with the health centre or hospital out-patient department.

The following pathological conditions could be diagnosed at the basic radiological service level:

- skeleton: fractures, rheumatic lesions of joints, osteomyelitis and tumours;
- chest: tuberculosis, pneumonia and other infections, heart enlargement, tumours;

- abdomen: obstructions, renal and gall bladder calculi, tumours;
- soft tissues: radio-opaque foreign bodies.

In places where more skilled operators and diagnosticians are available some investigations using contrast media for the gall bladder, the urinary tract and the lower gastro-intestinal tract, could be added.

Diagnosis, that is film interpretation, would be carried out by the physician in charge of diagnosis and treatment at the institution where the basic radiological service is located. The physician would need special training and supervision from the radiologist located at the nearest hospital with an established general purpose radiological service.

The following factors are essential for implementation of the basic radiological service concept:

- easy access to patients referred from primary health care to better diagnostic facilities, without too heavy capital investment and running costs;
- use of personnel with shorter training as operators of basic radiological service machines. This would improve the chances of finding such personnel in order to obtain the appropriate coverage of the population;
- film interpretation made by the physician in charge of diagnosis and treatment;
- use of X-ray machines better adapted to conditions at the periphery in terms of operation, maintenance and repair, power fluctuations, availability of spare parts, etc.

The public health and economic aspects of the basic radiological service are not totally understood, because such units have so far been introduced only at a few sites in industrialized countries. It can be assumed that better coverage of the population would lead to improved diagnosis of many diseases and traumatic conditions, resulting in better treatment and follow-up. It is difficult without proper studies to define how much this will contribute to shortening hospitalization, reducing loss of working days and/or preventing incapacitating sequelae.

### 3.1.2 General purpose radiological service

This is a more advanced radiodiagnostic service, located in hospitals with many specialities. Such a service should be equipped with at least one X-ray machine, able to carry out all simple, and most specialized, X-ray investigations, including fluoroscopy. One radiologist and a few medical radiological technicians would be

required to staff such a unit and a planning figure of one unit per 250 000 to 500 000 population could be the target for the Western Pacific Region in the year 2000. The general purpose radiological service would have the responsibility for the technical supervision of all basic radiological services in the area.

### 3.1.3 Specialized radiological service

This service would be located in specialized and/or teaching hospitals equipped with general purpose radiological services, with in addition special machines for neuroradiology, vascular radiology, etc. Such units would be staffed by a few radiologists, qualified in the major specialities to be covered and a sufficient number of medical radiological technicians. It is understood that the specialized radiological service has to be assigned the technical supervision of the general purpose radiological services and to be responsible for teaching activities in the field of radiodiagnosis at all levels. Planning figures for specialized radiological services in the Western Pacific Region are not easy to estimate because of variations in population size and the fact that a specialized radiological service exists in most countries of the Region. At least for countries with large populations, a figure of one specialized radiological service for two to five million of the population seems reasonable as a target for the year 2000.

### 3.2 Radiotherapy

The aim of self-reliance in health care and the changing patterns of disease constitute strong arguments in favour of improving coverage with radiotherapy. Planning such services would have to take into account high capital cost, followed by the relatively small cost of running such services in developing countries. For economic reasons, and because of the need to have qualified personnel, radiotherapy services would have to be located in capital cities and a few large towns. It would not be rational to develop such services for countries where less than 800 to 1000 new cancer cases per year were expected, which means a population of two million per radiotherapy unit with an estimated cancer incidence of approximately 50 cases per 100 000 per year. That planning figure could be doubled if the unit had two <sup>60</sup>Co machines, as recommended by the WHO Meeting of Investigators on the Optimization of Radiotherapy, particularly for Developing Countries, held in Cambridge, England from 11 to 15 September 1978.<sup>1</sup> In developing radiotherapy services, the central unit, which should constitute the support for a specialized cancer institution, has to be given priority. Such a unit would develop the radiotherapy "know how" and establish the need for additional units in order to obtain better coverage. Alternative units, with simpler equipment or only brachytherapy - if the local cancer patterns are suitable for that type of radiotherapy - should be envisaged for provincial hospitals.

### 3.3 Nuclear medicine

The high capital and running costs of nuclear medicine units restrict the expansion of that activity. Rational planning has to start from the main teaching hospital of a country and further

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<sup>1</sup>WHO Technical Report Series (In press).

development should be envisaged only when financial and staffing possibilities permit. The idea of a basic nuclear medicine unit, with simpler equipment and radiopharmaceuticals, is a new approach of WHO and the International Atomic Energy Agency. Such a unit could be orientated towards solving particular health problems in the area of coverage (thyroid pathology, liver pathology, etc.). Another idea worth consideration is the use of radioimmunoassay techniques in assessing the results of the expanded programme on immunization and consideration is being given to such a project. Planning figures for nuclear medicine services are not yet defined. Studies in 1979 and 1980 should provide some clarification.

### 3.4 Radiation protection

The medical uses of ionizing radiations constitute the major man-made source of exposure throughout the world, even in industrialized countries. For that reason, national health authorities will have to consider the gradual expansion of radiation protection services. It is reasonable to establish a link between the development of radio-diagnostic, radiotherapeutic and nuclear medicine facilities and radiation protection services. As a planning approach, a figure of one person involved in radiation protection per 200 to 300 persons occupationally exposed to ionizing radiations in medicine, could be envisaged. That would represent minimum coverage but at least would initiate some radiation protection activity where it does not yet exist.

As a first step, all radiotherapy units should start radiation protection activities for the area of coverage, using the medical physicist attached to the unit. Emphasis would have to be placed on surveillance of all medical installations using ionizing radiations.

## 4. IMPLEMENTATION OF THE PLANNED RADIOLOGICAL SERVICES

In describing implementation of the planning mentioned in this document the role of WHO and the national health authorities should be considered.

### WHO's role would be:

- (1) to outline a methodology for planning, adaptable to the constraints of the health systems of Member States;
- (2) to build up the expertise required to cooperate with Member States in the application of methodology adapted to their particular circumstances, within the process of country health programming;
- (3) to lead the dialogue with manufacturers of equipment and research workers in order to obtain the most appropriate equipment for the radiological services, in terms of operability, maintenance, cost and quantity;

- (4) to develop training activities as necessary (formulate syllabi and curricula, establish the duration of training, assess requirements for each type of personnel to be employed within the programme, prepare manuals and teaching aids for developing countries);
- (5) to start large-scale studies on efficacy, efficiency and quality control in all fields of radiological activities, with a view to continuous improvement.

The role of national health authorities would be:

- (1) to implement the above-mentioned activities in order to provide the necessary coverage of the population;
- (2) to establish a dialogue with WHO in order to keep the Organization informed of the experience gained and thus allow continuous improvement in the planning/implementing process.