APPENDIX III

Spanish Guide for the Training of Medical and Technical Specialists

Appendix III-A

Spanish Guide for the Training of Medical Specialists

Diagnostic Imaging[*]

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* Taken from: España, Ministerio de Sanidad y Consumo, Consejo Nacional de Epecialidades Médicas y Consejo Nacional de Especialidades Farmacéuticas. *Guía de formación de especialistas*. Madrid: Ministerio de Sanidad y Consumo; 1986. (Free translation). (An updated version of this Guide was published in 1996.)

A) Definition of the Specialty

The specialty of diagnostic imaging is the branch of medicine that deals with diagnostic morphology, i.e., the study of images obtained through the use of ***ionizing radiation*** and other energy sources, as well as certain other diagnostic and therapeutic processes, the execution and control of which requires the use of such energy sources.

B) Sphere of Action, Nature of the Specialty, and Possible Areas for Specific Training

Through the program presented by this Commission, current specialists in diagnostic imaging will be trained to perform, interpret, and explain all diagnostic imaging techniques, as well as the diagnostic and therapeutic procedures generally carried out with the aid of radiological images.

Specific training areas considered are neuroradiology and pediatric radiology.

C) Content and Duration of the Training Program

The duration of the training program for diagnostic imaging residents will be four calendar years.

The theoretical component of the program will be imparted over the four-year period and will include courses in the basic sciences related to diagnostic imaging and subjects specific to the specialty.

The resident will receive instruction in radiation physics, radiation biology, and radiation protection, if possible during the first year. The teaching hospital will be responsible for ensuring that its residents obtain certification as supervisors of installations utilizing radioactive materials.

During the fourth year, the resident will receive instruction in the organization of diagnostic imaging departments.

The diagnostic imaging service will conduct a minimum number of sessions in radiology and clinical radiology, which will be indicated in the criteria for accreditation. Residents will attend all the such sessions and will collaborate actively in the preparation and execution thereof.

Residents' attendance at congresses, scientific meetings, courses, and conferences relating to the specialty will be facilitated.

Residents will take part in research from the beginning of their training. The diagnostic imaging service will encourage and facilitate the involvement of residents in research and will make it possible for them to complete their doctoral dissertations during their residency.

The specialization program will comprise rotations in the different sections of the service, according to the attached timetable.

Residents will complete one six-month rotation that will include internal medicine, surgery (five months) and radiological technique (one month). The latter is absolutely mandatory. The rotation in internal medicine and surgery is also considered mandatory, unless the resident can demonstrate to the local

education commission that during his/her education he/she has acquired the minimum necessary clinical training.

	3 Months	3 Months	3 Months	3 Months
1st year	Internal Medicine Surgery Radiological Technique		Chest	Bone
2nd year	Urology	Digestive System	Ultra-sonography	CT
3rd year	Neuro-radiology	Vascular Radiology	Mammography Gynecological Radiology OB/GYN Ultra-sonography	Pediatric Radiology
4th year	Ultrasonography Chest Bone Digestive System		Elective Pathological Anatomy Nuclear Medicine	
	8 Months		4 Months	

During the next eighteen months, residents will complete rotations in the areas that constitute basic radiology: radiography of the chest, bones, urology, and digestive system, ultrasonography, and computed tomography. Each rotation will last three months.

The third year will include rotations in those sections that require greater technical sophistication: neuroradiology; vascular radiology; mammography coupled with gynecological radiology, gynecological ultrasonography, and gynecological and obstetric ultrasonography; and pediatric radiology. Each of these rotations will also last three months.

In the fourth year, residents will spend the first eight months in another rotation devoted to ultrasonography and radiography of the chest, bones, and digestive system. In the final four months they will have the option of choosing a rotation in pathological anatomy, nuclear medicine, or an elective rotation.

All the techniques of interventional radiology, both diagnostic and therapeutic, will be covered in the corresponding rotations in the various sections.

Residents will be included on the on-call roster of the diagnostic imaging service; fourth-year residents, at the discretion of this Commission, may be given full responsibility both in their hospital on-call work and their daily duties.

D) Quantitative Requirements for the Program

It is difficult to present detailed quantitative requirements for the diagnostic imaging program. The requirements are closely linked to the criteria for accreditation of diagnostic imaging teaching centers and include the following:

1. Teaching hospitals should possess the necessary capabilities to practice all the techniques currently in use in our country. In some cases accreditation may be granted to a hospital that lacks two of the following four radiology

sections: pediatric radiology, neuroradiology, gynecological-obstetric radiology, and therapeutic interventional radiology. Single-specialty hospitals will not be accredited as teaching hospitals.

2. The accreditation documentation should clearly describe the purposes and objectives of the unit; its organization and administration; its management and staff; its physical facilities and equipment; programs, planning, and activities of the personnel; and a detailed training and ***quality control*** program.
3. No fewer than two, but no more than four, residents should be trained per year.
4. The service must carry out a minimum of 10,000 radiological studies per resident per year. Hence, with two residents per year, the total numbers of studies would be:
   10,000 studies x 2 residents x 4 years = 80,000 studies/year
   With four residents:
   10,000 studies x 4 residents x 4 years = 160,000 studies/year
   With three residents:
   10,000 studies x 3 residents x 4 years = 120,000 studies/year
5. The approximate percentage distribution of these studies would be as follows:

	%
Chest	40
Bones	30
Digestive system	8
Urography	5
CT	6
Ultrasonography	9
Vascular system	1
Other	1

   Each section must be actively practicing the various techniques of diagnostic and therapeutic interventional radiology.
6. With respect to the curriculum, the guide presented by the previous Commission is considered appropriate. That guide is contained in the "Guide for the Training of Medical Specialists: Section 36, Diagnostic Imaging Service."

Appendix III-B

Spanish Guide for the Training of Medical Specialists

Radiation Oncology[*]

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* Taken from: España, Ministerio de Sanidad y Consumo, Consejo Nacional de Especialidades Médicas y Consejo Nacional de Especialidades Farmacéuticas. *Guia de formación de especialistas*. Madrid: Ministerio de Sanidad y Consumo; 1986. (Free translation). (An updated version of this Guide was published in 1996.)

Radiation Oncology

1. Definition of the Specialty

Radiation oncology is a medical specialty concerned with the diagnosis, clinical care, and treatment of the oncological patient. It is primarily oriented toward the use of radiation treatments, as well as the use and assessment of the relative value of alternative or associated treatments, and research and education.

2. Sphere of Action, Nature of the Specialty, and Possible Areas for Specific Training

Radiation oncology as a medical specialty is concerned with the following:

2.1 Study of the natural epidemiological aspects, diagnosis, treatment, and follow up of all patients—whether or not they are oncological patients—for whom treatment with radiation may be indicated.

2.2 Study and application of the concepts of radiation physics to research, radiometry, clinical dosimetry, and the protection of personnel exposed to radiation.

2.3 Study and application of the concepts of radiation biology, both in the experimental and clinical fields.

2.4 Study and application of the physical agents used in the specific diagnostic techniques employed in radiation oncology (localization, centering, simulation).

2.5 Planning, execution, and control of radiation treatments.

2.6 Knowledge and application of treatments involving interstitial radiation therapy, the ***practice*** of which requires appropriate training.

2.7 Planning of treatment simulations and utilization of alternative and associated treatments in order to develop an integrated treatment strategy.

2.8 Early detection and prompt treatment of disease-related or iatrogenic complications.

2.9 Utilization of all available biological, physical, and technical resources in research and teaching programs in the field of radiation oncology.

Content and Duration of the Training Program

First year

The entire first year is devoted to general clinical training. The radiation oncology residents will be included on the on-call roster of the hospital and will work under the same conditions as residents in internal medicine.

During this year, optionally and in accordance with the directives of the education committee of each center, residents may participate in rotations in services related indirectly to radiation oncology

In any case, residents must complete at least 6 months' training in internal medicine.

Second year

Residents will complete a rotation of four months in radiation physics and dosimetry, the remaining months in the second year will be spent in the external radiation therapy section.

The education committees of the centers are authorized to distribute this time among these areas and other basic areas, if any are available (radiation biology, radiation protection, etc.), following the timetable that is most appropriate for each center.

During this period, residents should achieve the cognitive objectives in the basic sciences and radiation therapy.

Residents will be expected to attend the clinical and clinical anatomy sessions of the service at least once a week; general bibliography sessions and in-depth, single-topic seminars twice monthly, and at least four graduate lectures a year on subjects relating to the specialty.

Third year

In the third year residents will complete rotations in all teletherapy units and their complementary services and spend no fewer than four months in the brachytherapy unit.

During this period, residents should achieve all the cognitive objectives of the program.

Residents will be expected to participate actively in the clinical, clinical anatomy, bibliographic, and single-topic sessions.

Fourth year

In the last year, residents will perfect their skills by working, with increasing responsibility, in all sections of the service.

During this period, residents should achieve the psychomotor and affective objectives of the program.

Residents will participate in all the scientific and instructional activities of the service.

It is advisable that residents obtain certification as supervisors of installations utilizing radioactive materials.

Definition of Objectives for the Training of Specialists in Radiation Oncology

1. Cognitive objectives in the basic sciences of radiation therapy and oncology.
2. Cognitive objectives in external radiation therapy.
3. Cognitive objectives in brachytherapy.
4. Cognitive objectives in cancer chemotherapy.
5. Psychomotor objectives.
6. Affective objectives.

1. Cognitive objectives

1.00 *Basic Sciences*[1]

1.01 *Radiation Physics*. After completing the training program, the specialist will be able to:

- 1.01.1 Describe the atomic models that explain the phenomenon of the interaction of radiation with matter.
- 1.01.2 Describe the phenomena of natural and artificial ***radioactivity***, as well as the physical laws that govern them.
- 1.01.3 Identify the differences between electromagnetic and corpuscular, ***ionizing*** and non-***ionizing radiation***.
- 1.01.4 Describe the origin, nature, classification, and mechanism for the production of radiation used in radiation therapy (RT).
- 1.01.5 Describe the physical and physicochemical phenomena involved in the interaction of the radiation used in RT with matter.
- 1.01.6 Define the physical quantities and units used in RT, as well as their equivalencies.
- 1.01.7 Describe the methods used to detect and measure the radiation used in RT, as well as the equipment utilized.
- 1.01.8 Describe, qualitatively and quantitatively, the values that define the ***dose*** distribution in an irradiated material.
- 1.01.9 Describe the way in which the equipment used in the production and application of radiation in RT works.
- 1.01.10 Name the ***isotopes*** used in radiation oncology, identifying their specific physical characteristics.
- 1.01.11 Describe the mechanisms through which heat is produced in the body, as well as the generating apparatus and their dosage.

1.02 *Statistics*. After completing the training program, the specialist will be able to:

- 1.02.1 Define basic statistical concepts, as well as the statistical and biometric methods used in research and ***quality control*** in radiation therapy and oncology (RTO).
- 1.02.2 Give mathematic descriptions of linear, exponential, and logarithmic functions.
- 1.02.3 Explain the basic concepts of compartmental analysis and name its most important clinical applications.

1.03 *Information Science*. After completing the training, the specialist will be able to:

- 1.03.1 Describe the basic electronic components that perform logical-binary operations.
- 1.03.2 Explain the basic components of the hardware of a computer.
- 1.03.3 Describe the input/output units (peripherals) of a computer.

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[1] Objectives are numbered according to the following system: first digit—type of objective; second and third digits—specific subject matter; fourth and fifth digits—objectives.

1.03.4 Illustrate, using a block diagram, the sequence that links ordinary language with machine language.

1.03.5 Name the most common applications of data processing in RTO.

1.03.6 Describe the methods for developing and utilizing a database and file registry of clinical documents in RTO.

1.04 *History of Radiology*. After completing the training program, the specialist will be able to:

1.04.1 Explain how the concept of radiation therapy is applied in the various medical disciplines and describe the historical evolution of its application in these areas.

1.04.2 Describe the principal international and national schools of thought in radiation therapy.

1.04.3 Name the principal national and international radiation oncologists.

1.04.4 Describe the historical origins and principal milestones in the evolution of radiation therapy.

1.04.5 Identify the changes that have occurred in the application of radiation therapy, the dates when they occurred, and the reasons that prompted them.

1.05 *Radiation biology*. After completing the training program, the specialist will be able to:

1.05.1 Describe chronoradiobiology.

1.05.2 Describe the action of the physical agents (***ionizing*** and non-***ionizing***) used in radiation therapy, distinguishing between ***stochastic*** and ***deterministic effects***.

1.05.3 Describe the action of these physical agents on healthy or normal cells, tissues, organs, and whole bodies.

1.05.4 Describe the action of these physical agents on morbid cells, tissues, organs, and bodies.

1.05.5 Define the terms "latency," "fractionation," and "protection."

1.05.6 Define the terms "radiosensitivity," "radiocurability," and "radiation resistance," as well as the general principles of their clinical application and management.

1.05.7 Define postirradiation syndrome and disease, as well as the general principles of their clinical treatment.

1.05.8 Define iatrogenesis and the various types of iatrogenic effects (involuntary, deliberate, negligent), with assessment of the ***risk*** factors.

1.06 *Basic Oncology*. After completing the training program, the specialist will be able to:

1.06.1 Describe the differential characteristics of tumor cells and normal cells.

1.06.2 Describe tumor biology at the cell and tissue level, both *in vivo* and *in vitro*.

1.06.3 Describe the mechanisms and causes of neoplastic cellular transformation.

1.06.4 Define the epidemiological methods used in research and clinical ***practice*** in oncology and radiation therapy.

1.06.5 Describe the characteristics and histological varieties of malignant neoplasms.

1.06.6 Describe the immune mechanisms and other aspects of the tumor-host relationship.

1.06.7 Explain the basic principles of treatment with hormonal and immunological chemotherapy agents.

1.06.8 List and describe the various chemotherapy agents.

1.06.9 List and describe the ways in which the various chemotherapy agents work.

1.06.10 Explain the pharmacodynamics and pharmacokinetics of the various chemotherapy agents.

1.06.11 Explain the results of hormone determination tests.

1.06.12 Describe therapeutic procedures, indicating route of administration, specific treatment modalities, maximum ***doses***, ***dose*** modification factors, etc.

1.06.13 Describe the adverse effects of the various chemotherapy agents.

1.06.14 Describe the indications and contraindications for use of the various chemotherapy agents in the treatment of solid tumors and hematological cancers.

1.07 *Clinical Management of Diseases Susceptible to Treatment with Radiation Therapy*. After completing the training program, the specialist will be able to:

1.07.1 Describe the diseases susceptible to treatment with radiation therapy, including their etiology, pathogenesis, symptomatology, staging, pathological anatomy, differential diagnosis.

1.07.2 Name and describe the principal disease classification systems (the International Classification of Diseases [ICD] of WHO, the TNM [tumor staging] system of the International Union Against Cancer [IUAC], FIGO, etc.).

1.07.3 Describe and classify the principal pharmacological agents (not chemotherapy agents) utilized in the treatment of diseases susceptible to radiation therapy (radiosensitizers, radioprotectors, anti-inflammatory drugs, symptomatic medication, etc.).

1.08 *Radiation Therapy Technique*. After completing the training program, the specialist will be able to.

1.08.1 Describe the various techniques used in the treatment of diseases susceptible to radiation therapy.

1.08 1.1 Delimit the field of RT within RTO, as well as its interrelationships with the other medical-surgical specialties.

1.08.1.2 Define the concept of external radiation (ER) therapy and its significance within radiation therapy and oncology (RTO).

1.08.1.3 Define the concepts of curietherapy and brachytherapy and their significance within the field of RTO.

1.08.2 Classify the various techniques used in treating diseases susceptible to radiation therapy in terms of:

1.08.2.1 Energy.

1.08.2.2 Proximity of the ***source*** to the irradiated object.

1.08.2.3 Movement or non-movement of the ***source***.

1.08.3 Determine the indications and contraindications for ER and for curietherapy and brachytherapy, used alone or in combination.

1.08.4 Describe the various RT techniques used for each disease susceptible to treatment with radiation therapy.

1.08.5 Describe the theoretical basis underlying the particular characteristics of curietherapy and brachytherapy.

1.08.6 List the indications for external radiation therapy and for curietherapy and brachytherapy, according to nosological entities and their localization.

1.08.7 Analyze the therapeutic outcomes that can be achieved through exclusive treatment with radiation therapy in any of its modalities, according to pathological anatomy, localization, and energy.

1.08.8 Analyze the therapeutic outcomes that can be achieved through the combination of RT with other medical and surgical methods of treatment.

1.08.9 Describe the treatment of iatrogenic complications.

1.09 *Radiation Protection and Legislation.* After completing the training program, the specialist will be able to:

1.09.1 Define the effects of ***risk***, harm, detriment, and justification (ALARA index) and ***dose limit*** in the use of radiation ***sources*** in radiation therapy.

1.09.2 Specify the ***dose limits*** for those exposed occupationally and for the general public.

1.09.3 Describe the various operational methods and techniques for reducing ***exposure*** to the lowest possible level, or in any case keeping it below permissible levels.

1.09.4 Distinguish between individual and collective protection and describe personal dosimetry methods.

1.09.5 Identify the critical organs for the various radiotherapeutic techniques, as well as their respective tolerance ***doses***.

2. Psychomotor objectives

(Note: Although it is recognized that there is currently a trend toward teamwork within this specialty, which is practiced almost exclusively in tertiary-level hospitals, the educational objectives described here are presented as skills to be learned by individual practitioners. Nevertheless, the expression "will be able to..." does not necessarily mean that the practitioner will actually use each skill in his/her professional activities.)

2.00 *Basic Sciences*

2.01 *Radiation Physics.* After completing the training program, the specialist will be able to:

2.01.1 Use the dosimetry instruments for the radiation ***sources*** used in radiation therapy.

2.01.2 Measure and calibrate the radiological installations for which he/she is responsible, or delegate this responsibility to the physicist or other authorized specialist.

2.02 *Statistics*. After completing the training program, the specialist will be able to:

2.02.1 Apply the basic concepts of statistics (probability, mean, standard deviation, Gaussian and Poisson distributions) and correlation techniques, assessing the significance of the results.

2.02.2 Calculate and interpret data curves of various biological events.

2.03 *Information Science*. After completing the training program, the specialist will be able to:

2.03.1 Analyze and program basic problems that arise in his/her daily practice.

2.03.2 Use a computer (dedicated microcomputer for general use or for use in ***CT***) for treatment planning and calculation of optimal isodosis in radiation therapy.

2.07 *Clinical Management of Diseases Susceptible to Treatment with Radiation Therapy*. After completing the training program, the specialist will be able to:

2.07.1 Personally take patients' medical histories.

2.07.2 Personally collect the data from clinical examinations for diseases susceptible to treatment with radiation therapy.

2.07.3 Request and assess complementary examinations related to diseases susceptible to treatment with radiation therapy.

2.07.4 Diagnose diseases susceptible to treatment with radiation therapy, and especially in the case of neoplasms:

2.07.4.1 Determine the extent to which they have metastasized.

2.07.4.2 Stage the neoplasm according to the TNM system or another system specific to certain neoplastic localizations (e.g., FIGO).

2.07.5 Determine the indications and contraindications for the various treatment techniques and assess what combinations of techniques will be most appropriate in the case of the various diseases susceptible to treatment with radiation therapy.

2.07.6 Prescribe treatment for patients with diseases susceptible to treatment with radiation therapy, specifying:

2.07.6.1 In the case of radiological treatment: the technical data in the broadest sense.

2.07.6.2 In the case of chemotherapy: the treatment plan.

2.07.6.3 In the case of surgical treatment: why surgery is recommended.

2.07.6.4 In the case of combination treatment: in addition to the foregoing, the sequence for the use of the various treatment modalities.

2.07.7 Prescribe support therapy (psychological, rehabilitative, pain relief, medical, etc.) appropriate to each case.

2.07.8 Manually calculate the isodose distribution prior to the commencement of external radiological treatment.

2.07.9 Assess patient response to treatments and recommend modifications in the treatment plan if necessary.

2.07.10 Plan follow-up for each patient with a disease susceptible to treatment with radiation therapy, setting the appropriate dates in each case for successive follow-up periods, individually and in combination with an interdisciplinary unit.

2.07.11 Determine the most likely prognosis prior to the administration of the first treatment and make modifications based on the results of the treatment.

2.08 *Radiotherapeutic Technique*. After completing the training program, the specialist will be able to:

2.08.1 Carry out external irradiation treatments by him/herself, or delegate this responsibility to a technician/technologist.

2.08.2 Carry out by him/herself, with the necessary collaboration, interstitial and intracavitary treatments, determining the ***radionuclide*** to be used, ***activity***, mode of application, etc.

2.08.3 Collaborate with the surgeon in interstitial applications that require major surgery, especially in those in which insertion of a ***source*** into a cavity is necessary.

2.09 *Protection in Radiation Therapy*. After completing the training program, the specialist will be able to:

2.09.1 Put in place the radiation protection measures provided for in current legislation on RT services.

2.09.2 Establish special protective measures in each case for the management of physical agents used in radiation therapy.

2.09.3 Assess protective measures for ***radioactive waste***.

2.09.4 Implement radiation protection and safety measures in the daily operations of RT services.

2.09.5 Plan radiation protection and safety measures at work for potentially ***exposed*** persons of ***members of the public*** and the general population.

2.09.6 Establish and carry out ***emergency plans*** in case of ***accidents*** that might occur in the handling of radiation ***sources***.

2.10 *Diagnostic Imaging*. After completing the training program, the specialist will be able to:

2.10.1 Correctly use a simulator for radiological treatment.

2.10.2 Obtain the information needed from diagnostic equipment to make dosimetric calculations for radiological treatments.

2.11 *Nuclear Medicine*. After completing the training program, the specialist will be able to:

2.11.1 Utilize by him/herself, with the necessary collaboration, the techniques of nuclear radiation therapy.

2.12 *Physical Medicine*. After completing the training program, the specialist will be able to:

2.12.1 Operate equipment that generates non-***ionizing radiation***, used alone or in conjunction with radiological treatment.

3. Affective objectives

After completing the training program, the specialist will be able to:

3.03.1 Collect, organize, and transmit data on treatments, following the most appropriate method to contribute to scientific progress.

3.03.2 Systematize the sources necessary for periodic review of the data acquired from patients.

3.08.1 Adequately inform patients and their family members of the characteristics of radiological studies, their ***risks***, and the potential benefits that justify them.

3.08.2 Adequately inform patients and their family members about the various possible treatments, assessing the ***risks*** and benefits of each.

3.08.4 Participate actively in the preparation of patient follow-up plans.

3.08.5 Critically evaluate treatment outcomes, employing all available scientific means of verification, and complete the information acquired, using all the resources available to him/her professionally, without waiting for it to be requested.

3.09.1 Inform the public about the type and magnitude of the potential ***risks*** associated with radiation therapy activities.

3.09.2 Assess the ***risk***-benefit ratio in choosing among possible treatment options.

3.09.3 Monitor the application of radiation protection measures and measures taken to prevent the ***contamination*** of people, installations, and the environment.

3.13.1 Train the personnel assigned to the various functional units within the service.

3.13.2 Identify opportunities for utilizing applied research in his/her work.

3.13.3 Promote scientific meetings and participate actively in them

3.13.4 Update his/her knowledge and skills, utilizing the necessary sources

3.13.5 Organize a primary-care-level radiation therapy service.

4. Required achievement levels

After completing the training program, the specialist will have mastered:

4.01 Ninety percent of the objectives and contents established for the licentiate period at the end of the first year of the specialization program.

4.02 Eighty percent of the objectives and contents established for the specialization period by the end of that period