PRNC009

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RADIATION Su

joint Rvey

COMMONWEALTH OF PUERTO RICO

NUCLEAR CENTER

DEPARTMENT OF HEALTH

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EVALUATION OF HEALTH HAZARDS DUE

?TO UNINTENTIONAL IRRADIATION OF THE

GONADS DURING ROUTINE ABDOMINAL X.

RAY EXAMINATION OF MALE AND FEMALE

PATIENTS IN PUERTO RICO.

REPORT NUMBER 3 - SURVEYED AREAS OF THE NORTHERN REGION

ARECIBO - BAYAMON - CAGUAS - FAJARDO AREAS.

MICHAEL GILEADI - SENIOR ASSOCIATE

PUERTO RICO NUCLEAR CENTER

MAY 1971

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morro

?1 believe it le importent that we keep in mind that our goal is not to deny or even delay « single x-ray examination that is needed by a patient. Rather, we wish to develop {system such that only those x-rays are given whick are needed and only the best techniques are employed to reduce the average doses from x-ray examinations to not more than 10% of present values",

Dr. Karl, Z, Morgan, Director

Health Physies Division, Oak Ridge National Laboratory

(From the tsimony presented before the House of Representatives

?on bil HR. 10700, Ostober 11,1967)

?The primary purpose of the Joint X-ray Radiation Survey sponsored jointly by the Puerto Rico Nuclear Center and the Department of Health of the Commonwealth of Puerto Rico isto evaluate possible radiation hazards associated with selected groups of xray diggnostic procedures.*

* The responsibility for radiation protection and control ? associated with the use of

radiation in medicine, education and commerce in Puerto Rico ~ rests with the Radio-

logical Health Program, in the Department of Health of the Commonwealth of

Puerto Rico.

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ACKNOWLEDGEMENT

?TO ALL THE WONDERFUL MEDICAL WORKERS

IN THE SMALL AND IN THE BIG COMMUNITIES,

WHO IN SPITE OF THEIR TREMENDOUS WORKLOAD

80 WILLINGLY DEVOTED THEIR TIME AND EFFORT

?TO HELP US IN THIS SURVEY

? THIS THIRD REPORT 1S DEDICATED ?

w

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INTRODUCTION

This i the thind prognese report within the (ramesonk of the Joint Radeation Survey, sponsored by the Deparonent of Health of the Comonseatth of Puerto Reco and the Puckto Rico Nuctear Center.

1£ contaéns infomation neLated £0 the evatuation of possibte health hazards associaced with a sckected group of déagnostie x-ray procedures performed i tie four contrat and noncheascern arcas of the Northern Region of Puerto Rico, namely Arecibo, Bayambn, Caguas and Fajardo. This is a densely populated region, with

4 fotat population of 1,168,500, Host of the information 4s presented ix the Jor 04 statuscicat and dosimetric data-vatuabte both per se and within the concert on the hazards" evatuation,

As the survey progressed, mone and mone rane gécations of the problem becare apparent. This is signesicant, since oun most effeccent weapon ix radiation Protection is posssblu the knowledge and the auanencss of potential hazards associated with certain procedures,

This Aepont contains an appendix on radiotherapy practices in Puerto Rico;

40 cur knowtedge, the (inst survey on chih subject, Since the first a-rey wet ts brought £0 the Tadand én 1912-£0 La Princesa prison in San Juan by DR. Jeee Canboncte, and the Sirs Gity miLignams of radium were Loughe by OA. 1. Gonzdter Martine: in 1925-both diagnoses and therapy dn our communty have made enonmeus Progness. Today we have tency x-nay unite for various types of w-nay nadiztoon therany, about Gigeeen radionisotope units gon deep penetrating radiation and mone Bhan gift units in nuciear medécine.

Tn cur community, cancer is the sccond cause of death, The conbédenahle devetoprent of radiotherapy and nucteer medicine indicates the dimension of ?the esforts mut forth ayarnse chia major foe of aur portation, Nuckean med. cone,

wach mone than ans jedd of medicine haa bene feted Grom the chose caoperateor of

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various disciplines such ab electronic engineering, physics, chemistry and medicine, has made, enormous progress in the Last foe years in Puerto Rico, None than Len centers around the Istand, both public and private, are already using the most modern instuments gor nuckear-medicat procedures such as for renat function, tiyrodd uptake, blood volume determination, and nuclear scanning procedures for the inner organs of the body.

There s data pointing £0 a conelation between radiation and tumors in the boo:

owing organs leukemia], in the akin, sbeecon (sarcoma of the bone), in the lunge, Liver, ofc. Excessive radiation may reduce the Life span of the danadiated individual os Crradiation decreases the general Omunity of the body.

The fettowing table pointe £0 a shontening of the Life span of aadiotoginte die £o an accumutated occupational dose,

AVEPAGE AGE AT DEATH®
United States-1958

Physicians having no inom contact with radiation 65,7 years

Speciatists having some exposure £0 radiation

Wermetotogists, urologists, ete.) oss

Radiologists os"

In Puente Rico

?the avenage Life span or those oven age duenty Give in

1966 wos:

Mates = 67.49 years

Fenates = 73.11 yeans

+ Nationat Academy of Sciences-National Research Couneit. "The Biotogient Effects of Aconée Radiation". Suman Reports, Washington, 0. C. 1956,

* Puerto Rico Deparinent of Heatth, Division of Demographic Registry and Vital Statiaticn, 1968.

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The above statistical findings indécate that radiation damage may justly be considered as an occupational hazaad, and that we ought to investigate and determine the occupational exposures of various types such as the average exposure received by radiologists, xray technicians, radiotherapists, nuclear medicine Aechndccans and industriak workers deating with radiation scurces.

Te 4s oun intention £0 computerize our data for increcsed effiecency and {or better accensibiticy,

Tue to our interest in the well being of the younger generation, we abso Aitend to investigate radiation sources and measurements in the secondary schools and eotkege Laboratories, acheduled as a future joint project of the Departrent 06 Weacth and the Muckean Center, whose collaboration has produced such (rustut nesutes £0 date,

CO C6 fone

Entesto Coté Yokdén, H.0.

Secretary of Hi

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Per capi

SUMMARY

?annual gonadal doses associated with a selected group of abdominal and thoracical

X-ray diagnostic procedures have been determined in the four Surveyed Areas of the Northern

Region during 1968,

?The Genetically Significant Dose for the Northern Region of Puerto Rico 1968 will be evalu:

ated after completing the Survey of the San Juan Metropolitan Area, which probably has more

?The most significant results and data are tabulated below:

xy units than the four surveyed areas of the Northern Region,

Summary of Significant Results

[Surveyed are:

?of the Northern Region-i968

aguas

Fajardo,

Arecibo

Total

Wisber of diagaostic ira

unite (exclulfag dental xray!

nies) in Area

32

18

46

3

150

Total nunber of abdoninal

x-ray diagnostic examinations

terned "genetically hazardous?

performed in public instieu-

tions and in private offices

42,201

11,330

37,572

20,101]

ja1,208

Total aunber of thoracical examinations performed in public institutions and in | private offices |

89,654

12,638

78,209

43,493}

223,904

Number of x-ray Glagnostie |

examinations performed in

public institutions onl)

a1,710

43,211

133,916

44, 405}

53,262

fFotal nusber of all x-ray

Jdiagnoscic examinations

performed in public inetitu-

jeions and in private offices

ht66,933

48,803

166,596

77,102]

59,434

Population per_x-ray unit

Te

50

TBE

Thea]

T,

)Nusber of x-ray examinations

lper 100 patients in public

ineeitueions

18.2

10.5

2.0

as.8

Nunber of radiologiete tw

3

6

a3

Vopulation per radiologiots

184, 500

58,050

114,226

56,776

39,884

| Nean gonadat dose per about}

nal x-ray diagnostic examina:

tion (meade).

517.2

511.8

513.9

55.2

521.7

Mean gonadal dose per thoraci
cal x-ray diagnostic exani-
nation (rads)

0.93

1,03

70

1.04

88

Per capita per annum gona:

dose due to abdominal and

thoracical x-ray diagnostic

examinations (erads)

58.3

50.0

56.4

49.8

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?The Arecibo Area dose evaluations are based on dose measurement made at the Arecibo District Hospital using a Siemens-200 MA x-ray unit as iradiation source, This source was chosen as typical because of its frequeney of occurrence in thi area

?Doce evaluations in the Caguas, Fajardo and Bayamén Areas are bascd upon measurements rade on a Picker-200 MA unit - typical of these areas.

"An appendix added to this report contains information concerning Radiotherapy and Nuclear Medicine in Puerto Rico.

SURVEYED AREAS OF THE NORTHERN REGION

?The Northern Region consists of five Areas: (1) the San Juan Area, (2) the Arecibo Area, (8) the Bayamén Area, (4) the Caguas Arca, and (6) the Fajardo Arex

?Areas surveyed in this report include:

" Bayamon * 340,600

? Cogus 369,000

Fajardo? 116,100

?Total population of surveyed Areas + 1.168.600

?The four surveyed Areas represent the most densely populated parts of Puerto Rico.

?There are two District (Regional) Hospital in these surveyed Areas, one in Arecibo and one in Fajardo (in Caguas a Sub-Regional Hospital will be opened in July, 1971).

?The major medical facilities in the surveyed Areas include:

(a) 23 Health Centers

(b) 10 private hospitals

(eo) 9 private lines

(a) 4 Publie Health Units

(©) 3 1.B, hospitals and T.B. Centers

?There area total of one-hundred fifty diagnostic x-ray units in the Surveyed Areas (with the

?exception of dental units) and there were 459,434 x-ray examinations performed in the surveyed

?Areae in 1968, including 111,204 abdominal examinations termed ?genetically hazardous?. and

223,994 thoracical examinations, During the same time interval, 955,014 exposures (films) were made,

?During the year 1968, 459,494 diagnostic x-ay examinations among a population of 1,168.50

amount to an average of 39 X-ray examinations administered per 100 population. The global

gonadal dose received by the total population of 1,168,500 in the year 1968 was evaluated by

the present survey as 68,213,628 mrads, This figuee includes gonadal doses due to a selected

set of abdominal xray diagnostics as well as all thorscical x-ray diagnostics

Background Facts

Some basic background facts referring to the specific demographic and socioeconomic patterns of Puerto Rico are given herewith in an attempt to faciitate the understanding and interpretation ?of data and results presented within the framework of this Survey.

Puerto Rico isthe smallest and most easterly Island of the Greater Antilles with an approximate area of 3,439 square miles. Approxinutely 78 percent of its total area are mountains and hille~ the rest is @ narrow coastal area, with some valleys. The population of the Island was 2,799,100 in 1968 and the projected population for 1973 is 2,985,000. The mountainous area is preponder-

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ately rural, where the population lives in a rather traditional fashion. As a contrast the urban areas ace rapidly developing, indusrializing and changing their socioeconomic structure.

In the past Puerto Rico's economy was langely agricultural (sugar, coffee, tropical fruits, etc.) ~ but in the last two decades dramatic changes and tremendous technical developments have taken place, raising the average per capita income substantially

?The development of the economy was accompanied by even more significant improvements {in the field of health, the most significant ones being enumerated below?

(2) The death rate has been dramatically reduced from 20.9% in 1937 to 6.06 in 1970.

(b) Infant mortality has been reduced from 138.6 per 1000 live bieths in 1937 to 28.5 per

1000 live births in 1970.

(©) Deaths associated with deliveries andjor complications of pregnancy were 7 per 1000 live births in 1992, it has dropped to 5 per 1000 live births in 1970,

(@) Life expectancy increased from 48 years in 1940 to 71.7 in 1970,

?These achievements, no doubt, are due to improvements of public health, and of the socio-?economic level, especially during the last few years.!

Out of a total population of 2,739,100 in 1968 there were 1,261,300 males and 1,877.80 females. in the 15-29 age group the number of males and females was approximately equ however in the 90-44 age group the number of females was significantly larger: 181,00 males 88 compared to 218,500 females.?

Among others this may be a reason why the total number of x-ray examinations is higher for females than for males in Puerto Rico and so is the global gonadal dose to the female population.

For example, in the Bayamén Health Center a total of 16,749 photofluorographies were performed in 1968. Out of this, 3,850 were for male patients and 13,399 were for female patients. The preponderance of the female patients in photofluorography-cases was due to the fact that the Bayamén Health Center mostly screens the working population in the industrial area of Bayamén, of which about 80% are women.

In the Fajardo District Hospital it was pointed out by the Chief Radiologist that females receive 704 of the x-ray examinations in the hospital due to the specific demographic distribution of the ares,

?arly marriages are customary in Puerto ico; there were 149 live births to mothers below 16 in 1968 and 11,393 lve births to mothers within the 15-19 age bracket, Tota live birth in Surveyed Areas of the Northern Region-1968: 22,579.

LIVE BIRTHS RY MEDICAL PACILITIES AND BY LOCATION, P. R.~ 1968,

Geographie Government Hospitals, Private Home & Other

Location Municipal Hospitals & Hospitals Locations. T°**!

Health Centers

Caguas and 7.645, 1,975 536, 10,156

Fajardo

Arecibo 6,103 1,394 498 7,995

Bayamin 3,800 ?999 129 4.498

TOTAL 17,038, 4,368 4.363 22.519

Data based on Plan for Hospital and Medical F

Department of Health,

* Vital Statistics of the Departinent of Health, Commonwealth of P.R.

lites, 1968. Commonwealth of Puerto Rico,

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?The number of pelvimetries performed in 1968 inthe Surveyed Areas is 2.120, meaning that approximately one out of every ten live births was accompanied by a pelvimetry. Of 9.223 live biths in the Western Region in 1968, one of every three live births was accompanied by fa pelvimetry and in the Southern Region in 1968. which bad 13.981 live births, approxt imately one of every twenty-eight Ive births was accompanied by a pelvimetry

?Two levels of health care are conducted by the Puerto Rico Department of Health: focal Health Centers and District (Regional) Hospitals.

?The busie unit of health-care in Puerto Rico is the Health Center, which provides free medical care, preventive health services, and certain social services. There ate sixty-six Health Centers om the Iskind disteibuted among veventy-seven communities.

?There were five District (Regional) Hospitals operating on the Island in 1968"

(1) The District (Regional) Hospital i Ponee. serving the twenty municipalities comprising the Souther Region, with a 412 bed cspacity and 15 xray units, The total number of xray examinations performed in the hospital during 1968 was 33.126,

(2) The Fajardo District Hospital serves the seventeen munseipaitis comprising the Fase Area; has a 280 bed capacity and 8 x-ray? units. X-ray examinations performed in this hospital jn 1968 totaled 28,548 In number

(8) The Arecibo District Hospital, serving (teWve municipalities. has 280 beds and 6 ra units, The number of x-ray examinations performed in this hospital in 1968 was 33,800

(4) The Aguadilla District Hospital, also serving twelve municipalities, has 300 beds and 3

?enay units, In 1968, 27,569 «ray examinations were performed in his hospital.

(5) The Rio Piedras District (Regional) Hospial is also the University Hospital, This facily has 395 beds and 30 x-ray units. During 1988. 70,620 \-ray examinations were performed

?Also in 1968, there were four cuberculosis hospitals with T x-ray unit, two hospitals mental illness and one hospital for leprosy

In addition. there were 16 private hospitals with 38 xray units and 16 private lines with 25 xray units

?The following table shows the trend In exposures inthe last fifteen years in the District Hospitals.

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YORK PERFORMED IN THE RADIOLOGY DEPARTMENTS OF THE DISTRICT HOSPITALS *

MOMER OF EXPOSURES (FILMS) TAKEO IN THE DISTRICT WOSPITALS TH

HE LACT FIPTEEN FISCAL YFARS, Y-LOCATION AND BY YEARS.

?porayo Aico 1954-1970

r T

Yonge ff aguessite

1956-57 i 32,436 | 15,336 36,795 27,756 30,966

1957-58 14,246 | 19,988. youre 33,624

WL asus | s6ye2e 21,378 23,564 37,467

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COLLECTION AND ANALYSIS OF STATISTICAL DATA

Sarveyed Areas of the Northern Region

Puerto Rico ~ 1968

Following previous experience the data was collected by means of properly designed question-naires, mailed to all public and private medical facilites in the Surveyed Areas, along with a cover letter of the Deputy Secretary of Health, Dr. Carlos Nate.

Instead of using several questionnaires ~ as has been done in the previous part of the survey ? «special questionnaire was prepared for private medical offices in order to expedite data collection, ?A sample of this questionnaire and that of the cover letter is part of the report,

In spite of the high (70%) rate of response, it was nevertheless necessary to visit each facility because part of the returned questionnaires was not satisfactorily completed and because some of the data had to be rechecked,

Even though cooperation was in general very good, data {rom the majority of private offices was given on a weekly basis only, which understandably introduced certain inaccuracies in data compiling. For obvious reasons we chose to accept these inaccuracies instead of excluding the ?ures referring to the private sector.

?The breakdown of data by ayes also posed certain difficulties due to the fact that approximately 80f of both public and private medical facilities do not keep recorde of their patients? ages.

Logbooks in the x-ray departments of even the large District Hospitals were somewhat incomplete In some places the breakdown by ages was missing, in other places data for certain months bad not been entered, ete,

?The breakdown by age in private offices could only be estimated from the average weekly figures.

Hopefully computerization of data which is to begin next year in all District Hospitals

and some Health Centers will significantly improve this situation

In order to collect data in some of the private hospitals, we used a sampling technique choosing data from the files for the weeks of

March 1-6, 1968

June 9:13, 1968,

September 16-21, 1968

November 23-28, 1968

Al collected data were thoroughly checked for accuracy and reliability, and data pertaining to public institutions were confirmed by the signature of the responsible perton in charge. Once reliability and accuracy were established. data weee uniformized and tabulated, and certain rates and indicators of interest were derived, and suitable interpretations added, Wherever considered Aesirable figures were added for better presentation and clarification of the situation.

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RECOMMENDATION LETTER AND

?SAMPLE QUESTIONNAIRE

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ESTADO LIBRE ASOCIADO DE PUERTO AICO

DEPARTAMENTO DE SALUD

SAN JUAN. PUERTO RICO, 00908

24 de junto de 1970

a 1 Médicas de Hospitals Péblicos y Privados,

Médicos en Préctica Privada y Sadiélogos

De b Carton Be Miter, MD. eu

Subseceatario da S<Tid,

Asunto «Encuesta sobra radiaciés y eveluación de 1a trradiactén

Ae los génados durante los exénenes de rutina de Rayos X

fen lon honbres y Ian cujeres de Puerto Rico.

El Departanento 20 Salud, conjuntanente con el Centro Nuclear de

La Universidad dn Puerto Rico, parzeneciante a ia conisién de Energta Atéaica

de los Estados Unidos, es:é realinando wn estudio minucioso de todas las

facilidades de Rayos Xen Prerto Rico edtante una encuesta y una evaluacién

de los postbles peligros no intencionados que pudieran tener los diferentes wipes de Rayos X existentes en ia icla.

Ente ancuesta eat sealinfndose por el Sr. Michael Gileadi, M.5.5 Chenttétco Asoeiads del Cants> Yoclear de Puerto Rico, y sus ayodantes, quienes le vieitarén pedoimanent= paca explicarles cine se conduciré dicha Tovantigncion.

Ba ins Paginnne Onate y Sue de Puerto Rico se hizo un estudio
aintlar que fue ds aren provecho para teas Ine instituetones y médicos
privados, ya que se pido identifica: y earregir a thenpo pequefios defectos
fen los equipos que ofrectan alga peligro de radiaciém no inteneionada.
Al wisao thempo se pudo dataminar con ran xe(erto qué medidas tomar para
fevitar radiacign innecesaria a los génados de ambos sexos.

Rapermos que ne Ie ofrarca al aafor Giioadi 1a mayor cooperactén
y toda 1a inforackén neceancia para qua eata ovestigactén ctentifica &
Ingtructive tenga cl major de los Aettoa.

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?Table LN,

Table 2N,

?able 3:

Table 4:

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Table 6.

Table 7:

able 8

?Table 9.N.

table 10.8:

?Table 11-8:

?able 12.8)

?Table 13;

?Table 149N:

?Table 15-8)

?Table 16

LIST OF TABLES

Number of Abdoniinal Diagnostic X-ray Examinations by Area, by Type ot Examination and by Sex. Surveyed Areas of the Northern Region, Puerto Rico-1968,

Number of Thoracical X-ray Diagnostic Examinations by Type of Examination and by Sex. Surveyed Areas of the Northern Region, Puerto Rico-1968.

Number of Abdominal X-ray Examinations by Type of Facility and by Type

fof Examination, Surveyed Ares of the Northern Region, Puerto Rico-1968

Number of Films Exposed (Exposures) in Abdominal Radiography Examinations.

by Type of Facility and by Type of Examination, Surveyed Areas of the Northern Region, Puerto Rico-1968,

Nuraber of Films Exposed (Exposures) in Radiographic Examinations of the ?Abdomen and Thorax and by Type of Facility. Surveyed Areas of the Northern Region, Puerto Rico-1968.

Evaluation of the Mean Gonadal Dose due to a Selected Set of Abdominal X-ray Diagnostic Examinations in Surveyed Areas of the Norther Region, Puerto Rico-1968,

Evaluation of the Mean Gonadal Dose due to Thoracical X-ray Dingnostic [Examinations in Surveyed Areas of the Northern Region, Puerto Rico-1968.

?Total Number of Diagnostic X-ray Examinations tn Public institutions and Private Offices Compared to the Population by Areas. Surveyed Areas of the Northern Region, Puerto Rico:1988.

er Capita, per Annum Mean Gonadal Dos due to all Genetically Hazardous [Abdominal X-ray: Examinations, Surveyed Areas of the Northern Region, Puerto Rico-1968,

Per Capita, per Annum Mean Gonadal Dose due to all Thoracieal X-ray

Pxaminations. Surveyed Areas of the Northern Region, Puerto Rico-1968

Per Capita, per Annum Mean Gonadst Dose due to all Genetically Hazardous Abdominal and Thoracical X-ray: Examinations, Surveyed Areas of the Northern Region, Puerto Rico-1968,

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TABLE HN

MUNGIPRLITES IN SURVEYED AREAS OF THE NORTHERN REGION,

PUERTO RICO ~i968 ©

AREA MuNciPaL Ties

?caguas

Err)

tora

weaves

FRIUROO AREA, TOTAL

Saw orenzo | 36,500 eran

vanucon 31,900 canto

Scemo

CAGoAS AREA, TOTAL 369, 000, Sonora.

?areceo | arecwo Ramana

Streccone ra Srocows.

aor Sonata

aes, ros aus

wana

tenov's

pereraney

Srisco SURVEYED AREAS OF

Vesa basa 32,500 THE NORTHERN REGON

?AREGEO AREA, TOTAL

302, 600,

Orne ABOVE DATA ARE QUOTED FROM TWE ANWUAL VATA STATISTICS REPORT,

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TAQLE 2-N

DISTRIBUTION OF X-RAY UNITS BY GEOGRAPHIC LOCATION, BY

MEDICAL FACILITY ANO POPULATION PER X-RAY UNIT,

SURVEYED AREAS OF THE NORTHERN REGON

PUERTO RICO-1968.

wen ER | ERAS ease, T romnaron | eran

ee LOCATION FACLITY CRAY UNITS PER X-RAY

1 UNIT.

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TABLE 2-N (cow)

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area |Locarion

FAJAROO cea EAGT ENTER 13,000 | wo cna NT

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?RO GRANGE | HEALTH CENTER

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?veoues warn ere | 3,800 8300

FAJAROO AREA TOTAL 18 116,100

aac Teeter roar

?ARECIBO aa ¢

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* One Siemens xray unit is notin use because of the frequent overflow of the Rio Grande River waters.

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TABLE -2Ntcowr)

?Tesgenaenic [venom [MMSE OF Toonn anon [exanae? |

AREA LOCATION: FACILITY deRay UNITS [POPULATION | PER X-RAY

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sown) PRIVATE OFFICES s

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TABLE ~ 2N cont.)

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TABLE~2 Nicowr)

seocrapuic [weoicat NUMBER OF | popuarion [POPULATION

toca sary [pen fer Sera

awea | recur ay UNITS oR

BAYAMON AREA TOTAL 3a 340,600 | 10,017

SURVEYED AREAS OF THE NORTHERN REGON] 150 4168500 | 7790

Figures in Table 2N show that one xy ui res onthe strage approximately 6000-7000 people

?the Arecibo, Capuas and Fajardo Aus wheres inthe Bayamon §

?The total population of the Surveyed Areas of the Northern Region (1,168,500) is 78% larger than the population of the Western and Southern Regions combined (908,000), whereas the total number of x-ray units in the Surveyed Areas of the Northern Region is lese (150) than the ?number ia the Southern and Western Reions combined (161). Therefore, in the Surveyed Ares

(of the Northern Region, the number of population per x-ray unit (7,790) is larger than in the Southern Region (6,824/x-ray unit) aud in the Western Region (5.325/xeray unit)

After the completion ofthe survey and inclusion of the Mettupolitan Area in it, the number cof population per xray unit is expected to drop substantially due to the concentration of ?orgy units within the popuition of the Metropolitan Are

---Page Break---

TABLE 3.

OTQTAL NUMBER OF X-RAY EXAMRATIONS IN PUBLIC
INSTITUTIONS, TOTAL NUMBER OF PATIENTS AND NUMBER
(OF X-RAY EXAMINATIONS. PER 100 PATIENTS,

SURVEYED AREAS OF THE NORTHERN REGION, PUERTO _RICO-1968

Tay BARR] TOTAL AUWOER[OWSER OF 3-Ra

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TABLE 8N (CONT)

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TABLE 88 (cow

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cam HEALTH CONTER 20,278

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Visa Bask [WEALTH CENTER. 27,376

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Fveos eave Tora 33,570

+ tecteting 14,867 peter toeroeraehte.

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TABLE. 3H CCoNT)

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?Table 3.8, which indicates the ratio between the total number of patients treated in an institution and the number of diagnostic x-ray examinations per 100 patients in the same institution provides interesting information concerning the procedures practiced in the surveyed ?medical institutions.

?Some private hospitals have a ratio of $25 diagnostic x-ray examinations per 100 patients Aue to the practice of performing a routine chest diagnostic ray examination on nearly every admitted patient

Ft was found that (with the exception of the tuberculosis hospitals und tuberculosis centers where the number of S-ray examinations per 100 patients is understandably high), the largest number of diagnostic stay eNamtinations pee 100 patients were performed in private hospital.

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Table 6-N contains technical specifications of the x-ray units, year of installation, and other ?relevant data characterizing the performance of the x-ray unit. These data are not only indicative of the quahty of the radiography to be obtained by means of the particular xray unit, but also of the associated gonadal dose, This is so because the aperture of the xray beam is determined by collimation. Ifthe unit has no variable collimator, every radiography is obtained by a large ?sperture irrespective of the film size, even though from the diagnostic point of view only that Portion of the beam is useful which affects the film, or the screen, Thus, if an x-7ay unit is not ?equipped with a variable collimator all radiographies are done with a lage aperture thus placing the testes into the direct beam, at certain positionings such as Abdomen, Flat, Lumbar Spine and [LV.P., even though the part of the direct beam that goes through the testes does not artve to the film and is therefore superfluous from the diagnostic point of view. The role of the variable collimator is to eut down the aperture to the minimum size compatible with the diagnostic ?objective and thus exclude the testes from the direct beam whenever possible from the diagnostic point of view. Most modern x-ray units are equipped with variable collimators and thus their use tends to decrease the average gonadal dose. The ovaries are les likely to be excluded from direct beam than the testes. This is the most probable reason for the testical doses to be smaller than the ovarial doses in Puerto Rico'. In comparison, in the United States where the proportion of variable collimator equipped x-ray units is smaller than in Puerto Rico, it was found that the testical doses are in general greater than the ovarial doses,

A recent report of the U.S. Public Health Service, Oct, 1969, statad ?It was estimated that restriction of the x-ray beam to an area no larger than the film size would result in a reduction of the genetically significant dose from 65 to 19 millirads per person per year.?

Most x-ray units installed in public institutions in Puerto Rico after 1960 are equipped with

?Variable colimators snd in the last few years variable collimators have been installed on many ?older units. As may be seen from Table 5-N, in the lst few years the following changes in ?operating x-ray equipment have occurred in the Surveyed Areas of the Northern Region

2) total of 51 new x-ray units with variable collimator, installed in public or private offices,

2) 17 variable collimators were added to previously installed xray units,

8) 9 modern x-ray units (or mass chest examinations installed since 1966.

Other x-ray units in this Region include

1) 58 x-ray units with cones,

2) 18 x-ray units for fluoroscopy only, which were predominantly older units.

?The total number of x-ray units in the Surveyed Areas of the Northern Region is 150,

"Miller, James W.r Activities in the Division of Radiologica! Health Medical X-ray Program, Xray in Medicine and Industry, Proceedings of a Public Health Conference, Univ. of Miami, Bur. of Radiol. Health, March 1970.

---Page Break---

?Table 6-N shows that in sll the Surveyed Areas of the Northern Region, the nine sbdominal examinations considered ?genetically hazardous? represent approximately 25% of the total number of diagnostic x-ay examinations performed in 1968,

---Page Break---

?Table TN shows that thoracical xray examinations amounted to 59.6% of the total number ff <1ay examinations performed in the Surveyed Areas of the Northern Region in 1968.

eoce- 7

NUMER OF THORAOCAL X-RAY OUGNOSTE: EXAMBETIONS, BY TYPE OF EXAMNATIN

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See

SURVEYED AREA OF THE NORTHERN REGON

PUERTO.

TET OF DAGRISTC THORROCAL RAY EGG BY TPE

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mape-0n

NUMBER OF ABDOMINAL X-RAY EXAMMATIONS BY TYPE

(OF FaCLITY AND BY TYPE OF EXAMINATION,

SURVEYED, AREAS OFTHE AORTHERW REGION

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TABLE 10-W

NUMBER OF FILMS EXPORED (EXPOSURES) IN RADIOGRAPHIC

ExAMNATIONS "OF THE ABDOMEN AWD THOR BY TYPE

oF racuiTr

SURVEYED AREAS OF THE NORTHERN REGON PUERTO RICO-1968

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fuosoaus 4,900 | 57 169 102,069] frosmrais | 147366 | $7,169 4208,5

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PEEPS | 10,380 | 100,768) 9005 || RRTS 112,068 | 144,983

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ese | «3.209 | 11.396) enses | (P49, | sxiz0 | ruse6 | amcce

feePices | at fri:

par 36,590 | 65,873 | [EPMTS | 75,556 | 36,590 [112,146

rota 225,994 [335,198 || tora | 327720 | 2e7,204 [509,014

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s+ chang ofa) pntoinrotaphie, | thototivrearpiy: A wethd ehrahy « ptotoeaphy te tater of

---Page Break---

TABLE -IIN

EVALUATION OF THE MEAN GONADAL DOSE

QUE TO A SELECTED SET OF ABDOMINAL,

X-RAY DIAGNOSTIC EXAMNATIONS IN.

SURVEYED AREAS OF THE NORTHERN

REGION

PUERTO RICO -1968

eae area aay Ree

| TOTAL NUMBER | DIATION DOSE

AREAS ? | SEX| ,INATION MILLI oF ExaMINATIONS | TO ALL EMule

INED PATIENTS

MILLIRADS,

460.5 22,489 10,356,184

582.0 19,712 11,472,364

4462 Bisa 2,290, 790

566.3 6,196 3,508, 794

429.5 20,932 3,990,294

620.2 16,640 10,320,126

47.9 9,309 4,392,917

619.5 10,792 6,685,644

449.1 37864 | 26,030,185

598.8 33,340 | 3) 986,950

CAGUAS

FAJARDO

ARECIBO

BAYAMON

TOTAL

uM

F

?

F

M

F

M

F

M

ia

GRAND TOTAL 521 Te 111, 204 58,01 7,135

(COMPILED FROM TABLE {I-C,II-F,!I-A AND 11-8)

a

---Page Break---

TABLE -12N

EVALUATION OF THE MEAN GONADAL DOSE

QUE TO THORACICAL X-RAY DIAGNOSTIC

EXAMINATIONS IN SURVEYED AREAS OF THE

NORTHERN REGION,

PUERTO RICO-1968,

MEAN ABSORBED GLOBAL RRA

areas ? [sex [DOSE PER ExA-| TOTAL NuMBER | piaTION DOSE

MINATION MILLI-| OF EXAMINATIONS] TO ALL. EXA?

RADS MINED paTienTs|

MILLIRADS

cacuas | M 1.29 43,186 55,709

F oso | 46,468 27,860

Favaroo 1M 740 6,108 8,607

F 068 6,530 4,457

Ce 35,147 35,506

ARECIBO

F 0.44 43,062 15,267

O38

pavamon 183 16,617 30,4

F 35 26,876 14,858,

mi 125 TO1, 058 730,231

TOTAL F 3a 122, 936 66,462

RAND ToTal| ea 223,994 196,693

(COMPILED FROM TABLE 9-C,9-F,9-A AND 9-8.)

---Page Break---

TABLE -13.N

TOTAL NUMBER OF DIAGNOSTIC X-RAY

EXAMINATION IN PUBLIC INSTITUTIONS

AND_IN PRIVATE OFFICES AS COMPARED

TO THE POPULATION BY AREAS.

SURVEYED AREAS OF THE NORTHERN REGION,

PUERTO RICO?1968.

AREAS |TOTAL NUMBER INUMBER OF EXAM

OF EXAM. POPULATION|PER 100 POPULATION

ICAGUAS | 166,933 369,000 45.2

FAJARDO | 48,803 116,100 42.0

ARECIBO | 166,596 342,800 48.5

Bayamon | 77, 102 340,600 22.6

TOTAL | 459,434 1,168,500 39.3

---Page Break---

TABLE ?14N

PER CAPITA,PER ANNUM MEAN GONADAL

DOSE

QUE TO ALL GENETICALLY HAZARDOUS ABDOMINAL

X-RAY EXAMINATIONS

SURVEYED AREAS OF THE NORTHERN REGION.

PUERTO RICO ~-1968

GLOBAL ANNUAL | POPULATION

IRRADIATION DOSE | SURVEYED AREAS

TO ALL PATIENTS | OF THE NORTHERN

MRADS REGION PUERTO-

RICO R68

PER CAPITA

PER ANNUM

MEAN GONADAL

DOSE

MRADS

MALE 26,030,185, 572,565

a

FEMALE] 31,986,950 595,935

53.8

Total | 58,017, 135 1,1 68,500

TABLE-I5 N

E

49.7

PER CAPITA,PER ANNUM MEAN GONADAL DOSE

DUE TO ALL THORACICAL X-RAY EXAMINATIONS

SURVEYED AREAS OF THE NORTHERN REGION

PUERTO RICO-1968

GLOBAL ANNUAL | POPULATION

IRRADIATION DOSE | SURVEYED AREAS

| TO ALL PATIENTS | OF THE NORTHERN

MRADS REGION.

PUERTO RICO-1968

PER CAPITA

PER ANNUM

MEAN GONADAI

DOSE

MRADS

130,231 572,565

227

66,462 595,935

1,168, 500

2 FOZ 595,935

168

---Page Break---

TABLE~16N

PER CAPITA,PER ANNUM MEAN GONADAI. DOSE

QUE TO ALL GENETICALLY HAZARDOUS ABDOMINAL.

AND THORACICAL X-RAY EXAMINATIONS

SURVEYED AREAS GF THE NORTHERN REGION

PUERTO RICO ?

GLOBLAL ANNUAL) POPUL AT 1ON |per CAPITA

Fe ADIATION DOSE | SURVEYED AREAS |PER ANNUM

TOALL PATIENTS | OF THE NORTHERN |MEAN GONADAL

MRADS | REGION

58, 213,8

The pet capita per annum gonadal dace in the Sarvved Areas reached 49 8 mimds in 1868

Southern Rogion:1968

Jn the Western Reywon 1968

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bother Regions mentioned hove

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Figure 24:

Figure 3-8

Figure 4:

Figure 5-8:

Figure 6.8:

Figure 7-5;

LIST OF FIGURES

Public and Private Medical Institutions. Surveyed Areas of the Northern Region, Puerto Rico-1940-1968,

Percent Distribution of Diagnostic Abdominal and Thoracical X-ray Examinations in Medical Institutions by the Type of Facility.

Surveyed Areas of the Northern Region, Puerto Rico-1968.

Distribution of X-ray Diagnostic Examinations by Type of Examination ?Surveyed Areas of the Northern Region, Puerto Rico-1968.

Total Number of X-ray Examinations per 100 Population per Annum bby Geographic Location. Surveyed Areas of the Northern Region, Puerto Rico-1968,

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FloURE I-W

GEOGRAPHICAL, DISTRI f

Faeeire's eagmnes witn xcAat Outs

SURVEYED AREAS. OF THE NORTHERN REGON

?PUERTO RICO-1968

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FiuRE 2N

DISTRBUTION OF CRAY DIAGNOSTIC. UNITS

REENED: AREAS GF THE NORTHERN REGON

PUERTO RICO ?I968

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FIGURE-4N

VARIATION OF POPULATION AND NUMBER OF

X-RAY DIAGNOSTIC UNITS IN PUBLIC AND

PRIVATE MEDICAL INSTITUTIONS

SURVEYED AREAS OF THE NORTHERN

4 REGION PUERTO RICO - 1940-1968.

1,168,500

150

X-RAY UNITS

Hot

NUMBER OF

966,169

94

80

40.

851,089

20-- 7

1o-+

1940)

The small difference in population between 1950-1960 (30,810)
Probably be accounted for by a large emigration to the main~
id during this

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Figure 4N shows that the number of x-ay units in the Surveyed Areas of the Northern Region has increased witzin the period of 1960-68 from 94 to 150, a growth corresponding to 63%. ?This growth is primarily due to the expansion of the x-ray program in public institutions. the course of this expansion most obsolete x-ray units were replaced by modern units equipped with variable collimators. This feature ie of extreme significance from the point of view of radiation protection since the colimator reduces the beam size to the size of the film, thus Dutting the testes out of the direct beam in the diagnostic procedures termed Lumbar Spine, Abdomen, and ILV.P. For accuracy?s sake it should be noted that the ovaries will remain in

the direct beam in spite of collimation,

Dring the period 1940968, the number of diagnostic x-ray units within the surveyed Areas Increased from seventeen to one hundred fifty. These figures do not include dental x-ray uni Since, however, the population of the Surveyed Areas increased during the seme period from 851,089 to 1,168.500, the figure may be presented in « form standardized for population. Thus, in 1940 there were 1.99 units per 100,000 population and by 1968 this figure had risen to

128 units, representing close to a sevenfold increase

---Page Break---

FIGURE 5-N

PERCENT? DISTRIBUTION OF DIAGNOSTIC ABDOMINAL?

AND THORACICAL X-RAY EXAMINATIONS IN MEDICAL

INSTITUTIONS BY THE TYPE OF FACILITY.

SURVEYED AREAS NORTHERN REGION.

PUERTO RICO-1968.

HOSPITALS

30.45 %

(102,069)

PRIVATE OFFICES

19.65 %

(65,873)

CLINICS,

HEALTH CENTERS

rw)

PUBLIC HEALTH UNITS

35.53 %

(19,115)

+ Reference to Table 10-8.

ons ternad "genetically

4 apdominal diagnostic x-ray exami

Merardous?.

?4

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?The above figures clearly indicate the vital role of the Health Centers and Public Health Units in Health Services administered to the population of Puerto Rico,

?Among cther services Health Centers and Public Health Units ediminiter mass chest-?examinations

Another important role of Health Centers and Public Health Units is to make & diagnosis on the frst visit of the patient and in case af novwrsity to refer hm to the

?regional hospital

Health Centers and Public Health Units ere the primary nuclous for Health Services to the population - administering their kerviocs fren of char

Figure 6-N shows, that the largest portion of xray examinations (thoracieat and abdominal) in the Survoyed Areas were performed by Health Centers and Public Health Units, the second largest portion by hospitals. As a comparison there are quoted herewith the

parallel figures for the Surveyed Areas of the Northers Region, Sowers Region and Western Region,

Rercentage of Abdominal? ond Thororical Bxaminations
by Geographic Location an by

Hoevitals

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- _Publie Heslts Un

Surveyed Areas of the

Northern Region 38.05

Southern Region sum!

Western Region 33.46

* Abdomine! exeminations termed qoowsieolty hevarione,

?The concept of Health Centoes in Puezto Rico inclves gil Sena? Hospital uns

?The Public Health Unite are serving only ovtpstic

medicine.

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FIGURE ~ 6N

DISTRIBUTION OF X-RAY DIAGNOSTIC EXAMINATIONS

BY TYPE OF EXAMINATIONS

SURVEYED AREAS OF THE NORTHERN REGION.

PUERTO RICO -1968.

THORACICAL

OTHERS EXAMINATIONS.

27.04 % 48.75%

(124, 236) (223,994)

7

UPPER 7

1.03 % ABDOMINAL

EXAMINATIONS!

2850 %

pii204)

7 LOWER

13.27 %

+ See table, 8-

4 The munber of x-ray procedures in the Upper Abdomen include: Chole-
cqetoeraphy, Linbet Spine and centrointeatinal Series. The lover
include: Abdomen, Barium Enema, I.V.P., Pelvis, Hip Joint
tnd Pelvinetey,

---Page Break---

FIGURE ~7N

NUMBER OF X-RAY EXAMINATIONS PER 100 POPULATION
PER ANNUM BY GEOGRAPHIC LOCATION.

oo SURVEYED AREAS OF THE NORTHERN REGION

& PUERTO RICO~I968

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a 452/100

2

- 42.0/100

g 40. 100

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THE AREAS-CAGUAS FAJAROO ARECIBO BAYAMON

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DOSE MEASUREMENTS

Surveyed Areas of the Northern Region

as

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?Accurate and reliable dose measurements are an indispensable requirement for evaluating the quantifiers used to characterize the radiation hazards,

In the framework of this part of the survey dose measurements were carried out using ?cray units typical of the area as irradiation sources. Such typical x-ray units were the Siemens 300 MA xcray unit in the Arecibo Regional Hospital and the Picker 200 MA unit fn the Health Center of Bayamén.

Measurements were carried out both in vivo and using « Rando phantom in lieu of the patient always accurately simblating positioning and collimating techniques used in actual procedures

?For a detailed description of the method and the instrumentation used for accurate and reproducible dose measurements as well as the computational method used for evaluating

the relevant quantifiers, the reader is referred to Report I of the Joint Radiation Survey pp. 53:58,

?Based of the census of x-ray units in the Surveyed Areas, dose rates measured at the Siemens 300 MA unit were used to evaluate the quantifiers in the Arecibo area, while for the same reasons in the Caguat-Fajardo and Bayamén areas dosimetric data measured on Picker 200 MA x-ray unit were used,

?Table 1D and Figuce 1D are instrumental in evaluating the half value layer and effective energy of the Siemens 300 MA x-ray unit.

?Tables 2D-4D and the corresponding figures 2D-4D present intercalibration data pertaining to the Siemens 300 MA unit. Figure SD shows the relationship of dose rates as measured jn vivo and on @ Rando phantom in identical xray diagnostic procedures.

cy

---Page Break---

?Table LD

Table 2D

Table 8D.

Table 4D:

LIST OF TABLES

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Tae Ho

DETERMINATION OF KVL. IN RAY UNIT SEMENS~ 3OOMA (PLEOPHOS 4),

VARABLE COLLIMATOR, TOTAL FILTRATION 3.5mm AL, TEMP 72°F

[ARECIBO OISTRICT HOSPITAL PUERTO RICO

nasonaen Thccness)CTOREEN 228 REAORG

EFFECTIVE ENERGY

$8B-1 630m

Jp2.7 8 OENSITY OF AL

TOTAL MASS, AL. COEFFIGENT

Pps

Kor. ?FF38.6 Kor

TUBE voLTAGE 76K.

?TABLE 20

LIF- TLD POWOER AND VICTOREEN 228 IONCHAMBER INTERCALIBRATION

DATA, HVL 4.25 m/m AL.

EXPOSURES MEASURED ON THE SURFACE OF SKIN. SIEMENS - 300

SeRAY UNIT, TUBE DYNAMAX 40, 100 MAS, TFD"90 cm. OIRECT BEAM

DISTRICT HOSPITAL , ARECIBO PR.

VICTOREEN | CORRECTION

228

READING Tor

READING TO.

mR tir

2,100

2,380 636

3,387

1645

4,000 44

627

?© BACKGROUND CORRECTION SUBTRACTED

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mame 30

LIF-TLo POWDER AND VICTOREEN-227 IONCHAMEER RTERCELIORATION

bara ExPOSURES WeASImNeD aT LOCATION OF THe TESTES 20cm CAUBAL

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Figure 1-D:

Figure 2D:

Figure 3D:

Figure 4D:

Figure 6-0:

List OF FIGURES

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INTENSITY

TRANSMITTED

FIGURE 1-0

DETERMINATION OF HALF VALUE LAYER BY

GRAPHICAL METHOD. TRANSMITTED RADIATION

VS. ABSORBED THICKNESS.*

SURVEYED AREAS OF THE NORTHERN REGION

PUERTO RICO

ABSORBER

THICKNESS:

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FIGURE -2D

LIF-VICTOREEN INTERCALIBRATION CURVE.

SIEMENS - 300 X-RAY UNIT

TFD=90cm

CENTRAL BEAM

(REF* TABLE-20)

LIF-TLD READING

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VICTOREEN-228

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TUBE VOLTAGE - K.V.

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VICTOREEN READING ~MR

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SIEMENS ~ 300 M.A.

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(REF? TABLE 3-0)

FIGURE- 3D

LIF-TLOD POWDER OOSIMETER AND VICTOREEN 228

INTERCALIBRATION CURVES.

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TUBE VOLTAGE ~ KW.

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FIGURE-4D

LIF-TLD POWDER DOSIMETER AND VICTOREEN 228

IONCHAMBER INTERCALIBRATION DATA.

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85 SIEMENS 300 M.A X-RAY UNIT

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(REF: TABLE-40)

VICTOREEN-226 REAL

LIF~TLO READING

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Figure ~ 30

NTERCALIBRATION CURVES OF TLD AND VICTOREEN ~ OOSMETERS

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MANUFACTURERS CALIBRATION REPORTS

FOR

VICTOREEN - 927 and VICTOREEN - 228,

IONIZATION CHAMBERS

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(Calibration Report

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CALIBRATION REPORT

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Register # WS ROC Serial MSP 48) 169 Model #222 209 435

X-RAY TECHNIQUE

(ioderately Filtered X-Rays)

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PRESENTATION OF STATISTICAL DATA

CAGUAS AREA

63

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?The Area of Caguas includes twelve municipalities in the Northeastern part of the Islnd, with « total population of 360,000. Caguas, founded in 1775, isthe largest city in the area ?with a population of 76,000

?The entire area and especialy the city of Caguas, is growing industrial and commercial section, There are six community hospitals~Aibonito, Caguas, Gurabo, Juncos, San Lorenzo and Yabucoa.

?There are accredited private schools such as Colegio Catélico de Caguas, Notre Dame High ?School, Colegio Bautista and public voestional schools.

?This area needs more general hospital beds. As in the Mayayliez Area (see Report Number (One) this results in a migration of patients to the areas of San Juan and Fajardo for medical services. Many films exposed in private and public institutions are sent to Fajardo for interpretation,

?An Area Sub-Regional Hospital i in the final stages of preparation for full operation; it will have six stationary Westinghouse x-ray units, and four mobile units with special grid contro.

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?Table 7-0: Number of Diagnostic Thoracical X-ray Examinations by Geographic Location, bby Medical Facility and by Sex, Caguas Area, Puerto Rico-1968,

Table &.C: Total Number of All X-ray Examinations, Total Number of Abdominal Examinations and Total Number of Thoracical X-ray Examinations by Medical Facility, Bayamén Area, Puerto Rico-1968,

?Teble 9-C: Mean Gonadal Dose per Patient due to Thoracieal X-ray Examinations, by ?Type, Caguas Area, Puerto Rico-1968,

?Table 10-C: Mean Gonadal Dose per X-ray Examination by Type of Examination and by Sex, Caguas Area, Puerto Rico-1968.

?Table 11-C: Computation of the Mean Per Capita Gonadal Dose due to a Selected Group of Genetically Hazardous Abdominal Diagnostic X-ray Examinations, (Caguas Area, Puerto Rico-1968,

?Table 12-C: Per Capita, Per Annum Mean Gonadal Dose due to All Genetically Hazardous ?Abdominal and Thoracical X-ray Examinations, Caguss Area, Puerto Rico-1968,

---Page Break---

TABLE 1-¢

MUNICTPALTTIFS OF THE CAGUAS AREA AND THEIR POPULATION

PUERTO RICD~1968*

MUNICIPALITIES

?Aguas Buenas 19,200

Aibonite 22,100

caguas 77,000

cayey 43,400

chara 23,400

arabe 20,100

Rumacao 34,200

Juncos 28,500

Las Piedras 17,800

Naguabo 20,900

?San Lorenso 30,500

Yabucoa

CAGUAS AREA TOTAL

+ The above data are quoted from the Annual Vital Statistics Report,

Commonwealth of Puerto Rico Department of Health, 1968.

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TABLE 10-C

MEAN CONADAL DOSE PER X-RAY EXAMINATION BY TYPF_OF EXAMINATION AND BY SEX

?CAGUAS AREA, PUERTO RICO-1968

Wiliivads per Fxanination

type of Examination Male Fenale

Cheat 1.68 2

Photofivorograpic 23 22

Tomographic 38.6 5.0

Abdonen 395.0 433.0

?Sholecystograph 10.0 180.1

Lumbar Spine 170.5 950.6

Gaserointeatinal Series 180.2 695.5

Barium Enema 1,210.0 750.4

Lue. 1,000.0 720.4

Petvie 246.2 o16

Hip Joint 100.0, 283.5

Pelvinatey : 1,100.4

18

---Page Break---

TABLE 11-c

COMPUTATION OF THY MEA PER CAPITA GONADAL DOSE DUF Tn A SELECTED GROUP OF GENETICALLY IAZARDOUS ARDOMINAL DIAGNOSTIC. X-RAY. EXAMINATIONS CCAGUAS AREA, PUERTO RICOW196R

Tema Sem Taba

Exposure | Adsorption | Total musher| Irradiation

ree Tose of Abdominal] Dose to all

Prams Per Miamostic? | Faamined

Type of winnie Examination | X-ray Patients

Examination __| Sex| roentgens_| hillirade?? | pssinations| niitin

Abdomen, M. 64 335.0 4.2m 71,434,470

F 470 43310 31752 15626,616

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Jazazhy Fr 196, paz 309,780

Lumbar x. 185 170.5 | 5,169 a1, 314

Sein F. | 1,033 g50:6 | 2ison | 2, 754/855

castroine % 196 190.2 3.220 380,266

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652.6 serio | igin2 | nara 38a

382.2 317.2 I 422 | 21,028,568

79

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TABLE 12-¢

PER CAPITA, PER ANNUM MEAN GONADAL DOSE DUE TO ALL

GENETICALLY HAZARDOUS ABDOMINAL AND THORACICAL X-RAY

EXAMINATIONS,

CAGUAS AREA PUERTO RICO-I968

GLOBAL ANNUAL POPULATION PER CAPITA

IRRADIATION DOSE} CAGUAS AREA | PER ANNUM

TOALL PATIENTS | PUERTO RICO MEAN GONADAL

MRADS 1968 MRADS

10, 411, 893, 180, 810 87.5

U1, 500,264 188, 190

21,912,157" 369, 000

80

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Modet

KvP

MA

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Westinghouse Electric Compony, S.A.

October 8, 1970

CAGUAS AREA HOSPITAL

Westinghouse X-Ray Equipment

Description

c-30 125 300 Operating Room 3rd Floor Room 3195

Double Tube, Explosion oR

Sale, GU and

Orthopedic Room 519%

MO-110 100 200. Explosion Safe Mobile 3rd Floor

oR

MO-120G 100 300 Capacitor Discharge Mobile ALL Wards

MO-1206 100 300 Capacitor Discharge Mobile ALL Wards

MO-120G 100 300 Capacitor Discharge Mobile Emerg. Warde

MO-120G 100 300 Capacitor Discharge Mobile Nursing Home

C40 125 300 Rad f Fluor 2 Tubes Ist Floor X-Ray Room 1320

C40 128 300 Rad f Fluor 2 Tobe Let Floor X-Ray Room 1323

c-40 125 300 Rad Fluor f Tomo f Stereo at Floor X-May Room 1324

2 Tubes

c-50 150 $00 Rad # Fluor # Image Int. # It Floor X-Ray Room 1327

Craneograph 3 Tubes

-40 125 300 G-U Rad Only 1 Tube at Floor X-Ray Room 1316

Notes: Dynamax 40, 1-2 mm tubes used, with exception of Room: / 427 (C-50) which

uses Dynamax 50, 2 mm aluminum added filters in all.

MO-120-C, Mobile uses grid control tube.

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Figure 1-0:

Figure 2C:

Figure 3.¢:

LIST OF FIGURES

---Page Break---

FIGURE Ic

SISTRBUTION OF MEDICAL FaCKITIES EQUIPPED

WITH GRAY UNITS BY aeooRAPNIC LOCATION

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Ficune - 2¢

DISTRIBUTION OF X-RAY DIAGNOSTIC UNITS , BY GEOGRAPHIC

LOCATION AND BY TYPE OF FAGLITY,

CAGUAS AREA, PUERTO RICO 1968.

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FIGURE- 3¢

VARIATION OF POPULATION AND NUMBER OF

DIAGNOSTIC X-RAY UNITS IN PUBLIC AND

PRIVATE MEDICAL INSTITUTIONS.

CAGUAS AREAS,PUERTO RICO 1940 - 1968

60.

80:

40.

30.

20.

YEARS 1940 1950 1960 1968

POPULATION 290,430 295,291 369,000

85

---Page Break---

PRESENTATION OF STATISTICAL DATA

FAJARDO AREA

86

---Page Break---

?The Fajardo Area consists of the municipalities of Fajardo, Ceiba, Culebra, Loita, Luguillo, Rio Grande and Vieques. The prosent population of the area is 116,100, This area comprises the extreme northeast section of the island of Puerto Rico.

?The municipality of Loiza is the most densaly populated with 32,800 inhabitants but Fajardo, with a population of 24,700, is the cultural and medical center of the ares.

?Two of the seven municipalities of this area are small islands to the east of Puerto Rico, fone of which, Culebra, is located seventeen miles off the coast to the east, Low atitud light rainfall give the island a vegetation sufficient to support large herds of white brahma cattle, the island's main industry. There are no medieal facilities forthe 900 inhabitants of Culebra, therefore, the facilities of the island of Vieques or the mainland facilities of Fajardo ate used

?The island of Vieques is ten miles southeast of the Puerto Rico mainland and has & population (of 8,400 inhabitants. The island has a Government Health Center equipped with an x-ray unit.

nd

LIST OF TABLES

Table 10-F: Mean Gonadal Dose per X-ray Examination by Type of Examination and by Sex, Fajardo Area, Puerto Rico-1968

Table 11-F: Computation of the Mean Per Capits Gonadal Dose Due to a Selected Group of Genetically Hazardous Abdominal Diagnostic X-ray Examinations, Fajardo District Hospital, Fajardo Area, Puerto Rico-1968,

?Table 12-F: Per Capita, Per Annum Mean Gonadal Dose due to Ali Genetically Hazardous Abdominal and Thoracical X-ray Examinations, Fajardo Area, Puerto Rico-1968.

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TABLE 1

MUNICIPALITIES OF THE FAJARDO AREA AND THEIR POPULATION

?PUFRTO RICO-196'

POPULATION.

MONICIPALITTES.

Ceiba 13,100

colebra 300

24,700

lotta 32,800

Loqut ito 12,100

Rio Grande 24,100

Meques 8,400

PASARDO AREA TOTAT. 116,100

4 The above data are quoted from the Annual Vital Statistics Report,

Commonwealth of Puerto Rico Departeent of Health, 196.

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TABLE 10-F

MEAN GONADAL DOSE PER X-RAY EXAMINATION BY TYPE OF EXAMINATION AND BY SEX®

'FAJARDO AREA, PUERTO RICO-1968

Wilitvade per Prasination

type of Examination Yate enale

Cheat 1.88 92

Photofiuorographic 223 2M

[Tomographic 34.2 4.9

Abdomen, 335.0 433.0

Jrotecyatography 10.0 200.4

Luabar Spine 170.5 950.6

lcestrointestinal seri 180.2 685.5

arin Eneca 1,210.0 250.4

nvr. 1,000.0 720.8

elvie 746.2 61.6

tip Joine 700.0 283.5

IPetvinece:

?* Mean gonadal aot jeaced tn the

on Picker 200 MA x-ray unit with Px-10 tube.

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?COMPUTATION OF THE MEAN FER CAPTTA CONADAL DOSE UF TO A SELECTED GROUP (OF GENETICALLY NAZAIDOUS ABDOMINAL DIAGNOSTIC ARAY PrAMTNATTONS

PAUARDO DISTRICT ROSPITAL, TAJARDO AREA, PUENTO RICOW1968

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TABLE-I2 F

PER CAPITA,PER ANNUM MEAN GONADAL DOSE DUE TO

ALL GENETICALLY HAZARDOUS ABOOMNAL AND THORACICAL

X-RAY EXAMINATIONS,

GLOBAL ANNUAL

IRRADIATION DOSE

TO ALL PATENTS

MRADS

FAJARDO AREA, PUERTO RICO-1968,

2,299, 397

3,513, 251

5,813, 436

116, 100

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LIST OF FIGURES

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DISTRIBUTION OF XRAY AGNOSTIC UNITS, SY

GEOGRAPHIC LOCATION AND BY TYPE GF" FAS ITY

FAJAROO AREA, PUERTO REO 1968,

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FIGURE 3-F

VARIATION OF POPULATION AND NUMBER OF DIAGNOSTIC

X-RAY UNITS IN PUBLIC AND PRIVATE MEDICAL INSTITUTIONS.

FAWARDO AREA,PUERTO RICO 1940-1968

20:

NUMBER OF X-RAY UNTS

3 a

Years 1940 7950 1860 1368

POPULATION 77,879 32,803 83,125 16,100

---Page Break---

PRESENTATION OF STATISTICAL DATA

ARECIBO AREA

100

---Page Break---

?The Arecibo Area is part of the San Juan Region. This area includes eleven municipalities on ?the north central coast of the Island. Arecibo is the largest city of the area; an important industrial and commercial center with a population of 83,400 in 1968.

In the Arecibo Area there are four Health Centers and five Municipal Hospitals and in the city of Arecibo, a District Hospital with a School of Nursing, a Municipal Hospital, a Public Health Unit and two private Hospitals

Table LA:

Table 2A:

?Table A:

?Table 4a

Table 5A.

Table 6A:

Table 7.

Table B.A:

?Table 9.4:

?Table 10-4

?Table tha:

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?Type of Examination and by Sex. Arecibo Area, Puerto Rico-1968,

Number of Diagnostic Thoracical X-ray Examinations by Geographic Location, by Medical Facility and by Sex. Arecibo Area, Puerto Rico-1968.

?Total Number of All X-ray Examinations, Total Number of Abdominal Examinations and Total Number of Thoracical X-ray Examinations by Medical Facility.

?Arecibo Area, Puerto Rico-1968,

?Mean Gonadal Dose per Patient due to Thoracical X-ray Examinations, by Type. Arecibo Area, Puerto Rico-1968.

Mean Gonadal Dose per X-ray Bxamination by Type of Examination and by Sex. Arecibo Area, Puerto Rico-l

Computation of the Mean Per Capita Gonadal Dose due to a Selected Group of Genetically Hazardous Abdominal Diagnostic X-ray Examinations.

Arecibo Area, Puerto Rico-1968,

Per Capita, Per Annum Mean Gonadal Dose due to All Genetically Hazardous ?Abdominal and Thoracical X-ray Examinations, Arecibo Area, Puerto Rico-1968.

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TABLE 1-A

MUNICIPALITIES OF THE ARECIBO AREA AND THEIR POPULATION

PUERTO RICO-1968"

MUNICIPALITIES i POPULATION

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tases | 24,600 |

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ARECIBO AREA TOTAL

+ The above data are quoted from the Annual Vital Statistics Report,

Commonwealth of Puerto Rico Department of Health, 1968.

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TABLE S.A,

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TABLE 10-A

MEAN CONADAL DOSE PER X-RAY EXAMINATION BY TYPE OF FXAMINATION AND BY SEX

?ARECIBO AREA, PUERTO RICO-1968

Willirade per Exanination

Type of Examination Male Fenale

Cheat 1.88 92

Photo fluorographic 223 a

Tomographic 2 6.0

Abdomen 340.4 533.6

Cholecystogeaphy 46.0 202.4

Lumbar Spine 161.0 1,104.0

450.0 | __s28.0

Barium Enema 1,268.0 om.

Lv.r. 1,158.0 763.6

Pelvis tL 754.0 64.0

Hip Joint mm 285.2

Pelvinetry 920.0

---Page Break---

TABLE L1-A,

COMPUTATION OF THE MEAN FER CAPITA GONADAL DOSE NUE TO A SELECTED GROUP

?OD GENETICALLY HAZARDOUS ABDOMINAL DIAGNOSTIC X-RAY EXANINATTONS,

?ARECIBO AREA, PUERTO RICO-1968

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wip Joint aie 71 724 52,684

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belvinety ee | 1000 920 5 102,500

total we | tose 129.5 | 20,92 | 8,990,296

rd a's aoa | injeco | 30,320,128

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raND TOTAL ss [sine | 37s | a9,s10,e22

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TABLE 12-A

PER CAPITA,PER ANNUM MEAN GONADAL DOSE DUE TO ALL

GENETICALLY HAZARDOUS ABDOMINAL AND THORACICAL

X-RAY EXAMINATIONS

ARECIBO AREA, PUERTO RICO-1968

GLOBAL ANNUAL _| POPULATION

IRRADIATION DOSE] ARECIBO AREA

TO ALL PATIENTS

PER CAPITA

PER ANNUM MEAN|

PUERTO RICO-I968| GONADAL DOSE

MRADS MRADS

9,025, 800 167,972

10,339,395

53.7

174,828 59.1

19,365,195

342,800

ng

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LIST OF FIGURES

---Page Break---

FORE 1-8

DISTRIBUTION OF MEDICAL FACILITIES EQUPPED WITH X-RAY UNIT

BY GEOGRAPHIC LocATION

ARECIBO AREA PUERTO RKO-1968

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FIGURE -2 8

DISTRIBUTION OF X-RAY DIAGNOSTIC UNITS, BY GEOGRAPHIC

LOCATION ANO BY TYPE OF FACILITY,

ARECIBO AREA, PUERTO RICO~ 1968.

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ARECIBO

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S-HEALTH CENTERS

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FIGURE- 3 A

VARIATION OF POPULATION AND NUMBER OF

DIAGNOSTIC X-RAY UNITS IN PUBLIC AND

PRIVATE MEDICAL INSTITUTIONS

ARECIBO AREA PUERTO RICO -1968

507 NUMBER OF

X-RAY UNITS

45.

40

35

30

25

20.

YEARS 1940

POPULATION 318,400 325,448 305,375 342,800

* not including denta? unite

123

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PRESENTATION OF STATISTICAL DATA

BAYAMON AREA

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?The Bayamén Area, comprising eleven municipalities with a total population of 340,600. is part of the Northern Region.

?The city of Bayamon, population 117,000, is highly industrialized and growing rapidly.

?The lack of adequate general hospital and other medical facilities in the Bayamén area! forees a flow of patients to San Juan for medical services and is a contributing factor in the heavy traffic on the Bayamén San Just highway, which impedes the dispatch of femergeney patients who noed immediate medical attention

LIST OF TABLES

?Table 1-8: Municipalities of the Bayamén Area and their Population, Puerto Rico-1968.

?Table 2B: Distibution of Disgnostic Xray Units by Medical Facility, by Geographic Location and Population per X-ray Unit, Bayamon Area, Puerto Rico-1968

?Table 9B; Total Number of X-ray Examinations in Public Institutions, Total Number ?of Patients, and Number of X-ray Bxaminations per 100 Patients, Bayamén Area, Puerto Rico-1968,

?Table AB: Distribution of Diagnostic X-ray Units in Operative Condition, by Medical Facility and by Manufacturer, Bayamén Area, Puerto Rico-1908,

?Table 5B: Census of Diagnostic X-ray Units. Bayamén Area, Puerto Rico-1968,

?Table 6B: Number of Abdominal X-ray Diagnostic Examinations by Medical Pacility, boy Type of Examination and by Sex, Bayamén Area, Puerto Rico-1968.

?Table 7B: Number of Diagnostic Thoracical X-ray Examinations by Geographic Location, bay Medical Facility and by Sex, Bayamén Arc, Puerto Rico-1968.

Table 8: Total Number of All X-ray Es Total Number of Abdominal

Examinations and Total Number of Thoracical X-ray Examinations by

Medical Facility. Bayamén Area, Puerto Rico-1968.

?Table 9-8: Mean Gonadal Dose per Patient due to Thorucical X-ray Examinations,

by Type, Bayamon Area, Puerto Rico-1968,

?Table 10-8: Mean Gonadal Dose per X-ray Examination by Type of Examination

and Sex. Bayamén Area, Puerto Rico-1968

?Table 11.R: Computation of the Mean Per Capita Gonadal Dose due to a Selected

Group of Genetically Hazardous Abdominal Diagnostic X-ray Examinations

Bayamén Area, Puerto Rico-1968,

?Table 12.B: Per Capita, Per Annum Mean Gonadal Dose due to All Genetically Hazardous

?Abdominal and Thoracical X-ray Examinations.

Bayamon Area, Puerto Rico-1968.

"Based on the Plan for Hospital and Medical Facilities, Commonwealth of

Puerto Rico Department of Health, 1969,

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TABLE 1-R

MUNICIPALITIES OF THE BAYAMON AREA AND THEIR POPULATION

PUERTO RICO-1968*

Municipalitie	Population
Barranquitas	
Bayamon	
Cataio	
Comerio	
Corozal	
Dorado	
Naranjito	
Orocovie	
Toa Alta	
Toa Baja	

Vega Alta

BAYAMON AREA TOTAL

* The above data are quoted from the Annual Vital Statistics Report,

Commonwealth of Puerto Rico Nepartment of Health, 1968.

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unin vars Picker-nada £3 the Reyanon Area, 1968)

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TARE 11-8

COMPUTATION OF THE MEAN PER CAPITA GONADAL DOSF. DU TA SELECTED GROUP

(OF GENETICALLY HAZARDOUS ABDOMINAL DIAGNOSTIC X-RAY EXAMINATIONS

BAYAMON ARFA, PUERTO RICO-1968

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Per

Framination [rer rota Examined

type of Mine Franinations [Number of | Patients

examination _|sex | roeacgens _|iitirads [reaninations | xiliireds

Abdomen Mey 364 335, | 2,060 690,100

F. aye 1 433 1,700 736,100

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Sane {ost i9s3__| 1,857,303

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Pelvis ? so | 1a os | 513,996

rm 6 i 62. 745 463190

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Rip Joint M 7 | 700 | sr 490,400

Fe 308 \ 286 | 616 174,944

Petvinetey 1199 | a0 596 653,400,

?Total mM. | 512.9 4719 9,309 4,392,917

Fo} on3 19:5 10792 | 6)685,644

GRAND TOTAL 599.0} sta | 20,101 }11, 078,561

a af |

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TABLE [2-8

PER CAPITA,PER ANNUM MEAN GONADAL DOSE

DUE TO ALL? GENETICALLY HAZARDOUS ABDOMINAL

AND THORACICAL X-RAY EXAMINATIONS

BAYAMON AREA, PUERTO RICO-1968

GLOBAL ANNUAL POPULATION | PER CAPITA

IRRADIATION BAYAMON AREA | PER ANNUM

DOSE TOALL. PUERTO RICO-I966 | MEAN GONADAL

PATIENTS bose

MRADS

4,423,326 166,894

6,709, 502 173,706

11, 124,996 340,600

---Page Break---

Figure 1-8:

Figure 2.8:

Figure 3.8:

LIST OF FIGURES

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FIGURE I-B
DISTRIBUTION OF MEDICAL FACILITIES EQUIPPED WITH X-RAY UNITS
BY GEOGRAPHIC LOCATION.
BAYAMON AREA, PUERTO RICO?1968

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3-HEALTH CENTERS A.

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FIGURE - 28

DISTRIBUTION OF X-RAY DIAGNOSTIC UNITS, BY GEOGRAPHIC LOCATION

AND BY TYPE OF FACILITY:

BAYAMON AREA, PUERTO RICO-1968,

TOA BAJA

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BaYAMoN

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TOA ALTA

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NARANWITO

coMERIO

oRocovis

PARRANQUITAS

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-Hospirats © 4-PUB.HEALTH UNTS AND Te, CENTERS [?]

2-cunies] S-PRIVATE OFFICES

3-HEALTH CENTERS A, o

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FisuRe 36,

NBRIATION OF POPULATION AND NUMBER OF AGNOSTIC

XRAY UNITS IN PUBLIC AND PRIVATE MEDICAL IST TUTIONS,

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Yea ioe "950. 960 1968

Peru. ane 88,37 ????3ai,817 3a, 713 "sa to

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APPENDIX I

RADIOTHERAPY IN PUERTO RICO

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?Table LR:

?Table 28:

?Table 38:

LIST OF TABLES

Distribution of Radionuclide Applicator Units Used for Deep Therapy

by Location, Type of Source and Source Activity,

Puerto Rico-1970.

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TABLE -1R

OSTRIBUTION OF THERAPEUTIC X-RAY UNTS USED FOR SUPERFICAL

TREATMENT BY LOCATION,

PUERTO RICO-I970

MANUFACTURER AND NUMBER OF PATIENTS

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MT OFFICE PROREK RAY *

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[Gworexcs) | 99

[Gwensac?! | 33

Jenevecrmc | 100

Sencectme | 1)

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APPENDIX II

NUCLEAR MEDICINE IN PUERTO RICO

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---Page Break---

STATISTICAL DATA ON NUCLEAR MEDICINE IN PUERTO RICO-1970

?The beginning of nuclear medicine goes back to 1994, when Nobel Laureate George De

Hevesy frst used heavy water to determine the total body water content of a patient.

In 1936,4. G. Hamilton and R. 8. Stone of the University of California administered Na-24 to patients for diagnostic purposes.

?The era of nuclear medicine began in earnest in August 1946,with the Ltst shipment of artificially produced radionuclides from Oak Ridge National Laboratory, Oak Ridge, Tennessee to a St. Louis, Missouri Hospital,

In Puerto Rico one of the first thyroid uptake determinations was delivered by the Nuclear Chemical Instrument Corporation (now Nuclear Chicago) in 1986, to the Mimiya Hospital in Santurce, Very soon nuclear methods became an inteytal part of diagnostie, ?roviding otherwise unavailable information om an organ and its function, 2s well oo Supplying corroborative evidence to support a suggested diagnosis. Morewver nuclear dliagnois| is safe and accurate, Today more than fifty nuclearmedical unite are operative fon the Island.

?The Atomic Enemy Commission's List of Licensee ~ authorized to own and use radioactive sources for nuclear medical purposes in Puerto Rico ~ enumerates the following facilities:

saciear sedieat Porvenes

onsienvartines

Presbyterian Hospital and

---Page Break---

Haring visited the above facilities it was leamed that out of the 10 physicians using radio-active nuclides in 1970, eight were practicing diagnostic and therapeutic nuclear medicine ?while two were practicing only diagnostic nuclear medicine

Radioactwe tracers are used to determine the in vivo distribution of the labeled materia

Relevant parameters entering in the choice of a certain radioactive tracer are among others, the energy and the half life of the emitted radiation,

?The emitted photons have to have sulficient energy to be detectable outside the body.

?Technetium 99m, which emits a 140 kev gamma ray, with no associated particulate radiation and which decays with a haf life of six hours is one of the tracers having the most Aesirable physical characteristics for in vivo applications

1.131 with a 0.637 mev gamma ray and a half life of 8.08 day was used in 9.811 thyrosd uptake studies in 1970, amounting to 81% of the total 11,518 function studies. 1131 was lused in more than 93% of all the function studies (thyroid and others)

Blood volume determination (442 cases) was genera y conducted by means of 1131 labeled albumin

?Another rather widely used radionuclide in function studies was Co-67 primarily for ?Vitamin B-12 absorption tes, It was used three times as frequently as the longer half life Co-60

Scanning procedures, based upon the differential concentration of a certain radionuclide in-a given body urgan were used in a total of 6,621 cases in Puerto Rico in 1970,as shown in the Table NM-3

---Page Break---

?Table LNM

?Table 2M:

?Table NM:

?Table 4.NM

?Table 5-NM:

?Table GNM:

?Table 7.NM:

LIST OF TABLES

Trainee, Country of Origin and Year of Training

Puerto Rico,

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PRNGPAL WCLEAR MEDCAL FACTION PROCEDURES PERFORMED DURING I970

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VITAMIN Bg AOSCROTIN

006 VOLME_O?TERMNTION

TSMneL ED TAN | VTA 8p ABSORPTION

LABELED Fars

be SuRviVAL

LORIE Om GRATE | ROM TURNOVER,

TCABELED-ALBOMN

?CARDIAC OUTPUT

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IMCIPAL MOCLEAR MEDICAL SAMNTNG PROCEDOES PERFORHED

---Page Break---

Teble 1 4 shows the brain acanning procedures by radionuclid

TABLE 1 &

Brain Scanning Procedues by Type of Radionuclides Used

Puerto Rico 1970

Tuber of | Percentage of

Procedures Radionucl id

| type of Procedure | performed | Performed ned

Brain Scanning 4,208 78.72 Te-99m

Brain Scanning 256 16.7% foers

Brain Scanning 6 bat ig-197,

Brain Scanning 8 SE ig-203

TOTAL, 2,535 300,02

Relative frequency of organ scanning is given in Table MM 5.

TABLE 1 5

Relative Frequency of Organ Scanning

Puerto Rico 1970

Tae Far tent

mhyroid 38.74

brain 23.17

Liver 16.96

Kidney 5.62

Lung 2.99

ovner 2.47

Total 190.00

---Page Break---

Table NM 6 gives the breakdown of pharmaceutical therapy procedures performed

in Puerto Rico in 1930,

TABLE 1 6

Principal Radiopharmaceutical Therapy Procedur

Puerto Rico 1970

Taber

Radio of Per

?Treatment Nuclide | compound Patients | cent

Nyperthvroidien | 1-131 | sodium todide| 180 91.83]

Thyroid Cancer | 1-131 | sodium todide| 11 5.68]

Soluble

Leukemia p-32__| Phosphate 4 2.44

Yalignant Colleidat 03]

Ef fusions Awei98 | cold 1 .

ES =p

TOTAL 196 __| 100.00]

Four various procedures in radiopharmaceutical therapy wete used in Puerto Rico ?in 1970. The number of administrations of 1-131 for therapeutic uses was 180, or 97% of all therapeutic treatment, 92% of all therapeutic procedures was for hyperthyroidism

?The Clinical Radioisotope Applications Division offers a basic course in clinical spplications of radioisotopes twice annually for physicians and other medical versonnel fand a nuclear medicine orientation course for medical technologiste

---Page Break---

TABLE 7-200

NUMBER OF TRAINEES IN THE CLINICAL APPLICATIONS DIVISTON -PRNC BY TYPE OF TRAINEE, COUNTRY OF ORIGIN AND YEAR OF TRAINING

PUERTO RIOD

rrr corey 7 Siar Toca

no of | of of | Now of

Year type of Trainees ftvainees| origin trainees | Trainees

1968 | Physicians (M.D.) 5 [argentina 1

Bolivia 1

Dominican Rep 3

Medical Technicians 2 | Ecuador 1

Venezuela 1

Medical Technolo, 43 [puerto Rico | 30

i? ogi Puert 3

1969 |Phyaicians (#..) 7 [Paraguay L

Medical Technicians 4 Jargentina L

oruguay 1

Spain 1

Puerto Rico | 7

Medical Technologists 51 |pominican Rep.) 2

Puerto Rico | 50 62

EE

1970 [Physicians (#.0.) 3 |oreece 1

Medical Technicians & [ecuador ?

JArgentina 1

Bolivia 1

venezuela i

Dominican Rep.| 1

Punrto Rico |_3 12

1971 Physicians (4.0. 5 [Peru 1

Medical Technicians 2 [columbia 1

olivia 1

Conta Rica 1

onde 1

puerto Rico | 2

? Medical Technologists 49___lpuerto Rico | 48 54

(RAND TOTAL 178

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