

DOES THE DIAGNOSTIC RADIOLOGY PATTERN CHANGE ?

Cornelia Diaconescu, Olga Iacob

Institute of Public Health Iasi

Abstract. Diagnostic radiology is the major contributor to population exposure in Romania. Previous estimates have put the contribution of medical X-ray examination at about 93% from all artificial sources. The pattern of radiological diagnosis at national level have been analyzed for the last decade as annual totals of X-ray examinations and the relative frequencies of different procedures. During 1990-1999, the number of all diagnostic X-rays per head of population decreased from 0.60 (1990) to 0.54 (1999). The relative frequency of different examinations, beside the large reduction of photofluorographies and in a smaller extent of fluoroscopies, remained unchanged. After 1995, computed tomography rise constantly so, in 1999 its contribution to total annual examinations was of 4%. Large differences between districts as CT annual relative frequencies (from 0.1 up to 24) appeared. A careful consideration of CT growth is necessary because substantially higher doses involved.

Key words: diagnostic radiology, X-ray exams, annual frequencies, tendency, CT

Rezumat. Radiologia diagnostică este sursa artificială cu cea mai importantă contribuție la expunerea populației. Evaluarea consumului radiologic anual, ca număr de proceduri și frecvența relativă a diverselor examinări röntgendiagnostice s-a făcut pe o durată de 10 ani. Exprimat ca număr de examene per locuitor, consumul radiologic a oscilat între 0,54-0,64 examene/an. Din 1995 apare o creștere anuală constantă la nivel național a utilizării tomografiei computerizate, care în 1999 ajunge la 4% din totalul procedurilor diagnostice. Se remarcă o distribuție geografică neomogenă a dotării unităților sanitare cu instalații tomografice, peste 70% din tomografe fiind amplasate în vestul și centrul țării. Utilizarea acestei relativ recentă tehnică imagistică impune o supraveghere atentă din partea autorităților abilitate în domeniul radioprotecției, fiind știut că tomografia computerizată implică doze de iradiere foarte ridicate.

Cuvinte cheie: radiodiagnostic, frecvență anuală, tendința consumului radiologic, tomografie computerizată

INTRODUCTION

Beginning 1970, the medical X-ray practices were under regular reviews in four national surveys (1-3) and the collective doses estimated. Covering a quarter of last century, these investigations showed that population of Romania receive from medical X-ray diagnosis the highest dose in comparison with other man made sources (2,3).

Although pointing out a continuous decrease of annual totals of X-ray procedures, they revealed an unchanged radiological pattern.

Meantime, the corresponding collective dose rise up to 13,8 man Sv, as consequence of obsolete radiological equipment (3).

By political and socioeconomic changes occurred in the last decade, the other diagnosis alternative become

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available to a larger extent (ultrasounds, endoscopy, CT, MRI).

In order to detect how these conditions influenced the radiology diagnostic pattern this paper reviews data on the radiodiagnostic practice during the period 1990-1999.

SOURCES OF DATA AND METHOD

The data of national statistics on radiology practice found at the National Center for Health Statistics and Information of the Ministry of Health and Family for the period 1990-1999, have been used (4).

Since a different classification of X-ray examinations was used before 1995, appropriate categories used in the last period (1996-1999) have been combined to form a common set of 15 types of examinations for comparison.

A more detailed analysis has been made for computed tomography (CT).

As a baseline for socio-economic conditions of different districts was used the gross domestic product (GDP) of population which structured the country into 4 categories of regional development (5).

Because the national statistics on diagnostic radiology do not include the age and sex of patients, the analysis is based only on the total number of examinations performed yearly.

RESULTS AND DISCUSSION

The total annual numbers of X-ray examinations classified into three main categories are shown in table 1.

Table 1. The total annual X-ray examinations (thousands)

Year	Total ⁽¹⁾	Main categories of X-ray procedures		
		Fluoroscopy	Radiography	Photofluorography
1990	13990	3987	6911	3092
1991	13748	3863	7108	2777
1992	13470	3687	7258	2525
1993	13599	3945	7552	2102
1994	14252	4138	7594	2520
1995	13972	3934	7792	2246
1996	14509	3772	7707	3030
1997	13638	3641	7972	2025
1998	13232	3404	8023	1805
1999	12257	3067	7587	1603

⁽¹⁾ dental included

The national annual frequencies of X-ray examinations in comparison with different countries in UNSCEAR Health Care Level I (HCL I)* (6,7) are presented as bar chart in fig. 1.

* The UNSCEAR Health Care System categorized the countries on physicians number per unit population: HCL I – at least 1 physician per 1000 population.

Examinations per 1000 inh/y

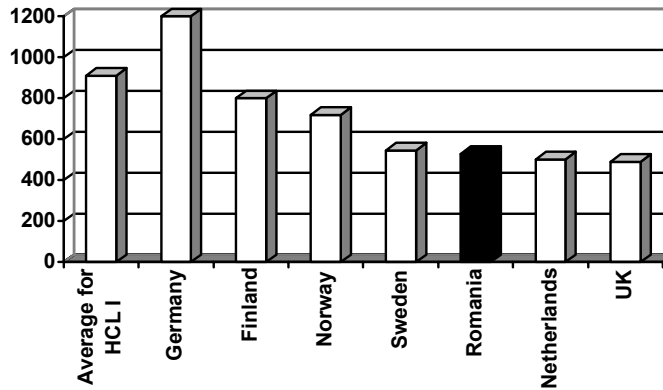


Fig. 1 Comparison of X-ray examination frequency in different countries

Excepting 1994 and 1996 years, the totals of diagnostic procedures decreased slowly. This decreasing tendency was obviously for photo-fluorographies that is from a relative frequency of 22.1 (1990) to 13.1 (1999).

Fluoroscopies whose relative

frequency was 28.5 in 1990 and dropped to 25.0 in 1999 (fig.2) are still frequently used, fact which discriminates Romania from the other countries of HCL I where the mean contribution of this procedure to total diagnostic X-ray examinations is 2.1% (8).

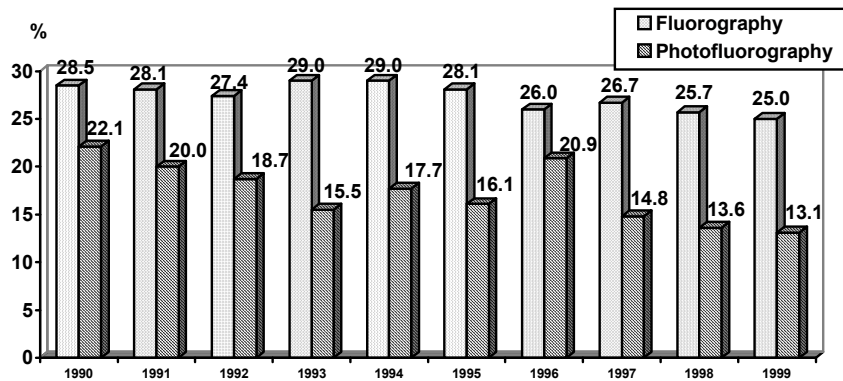


Fig. 2 The relative frequencies of fluoroscopic and photofluorographic examinations

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Expressed as X-ray examinations per head of population, the radiological procedures performed annually, show

small differences indicating a stationary temporal trend of medical diagnostic exposures (fig.3).

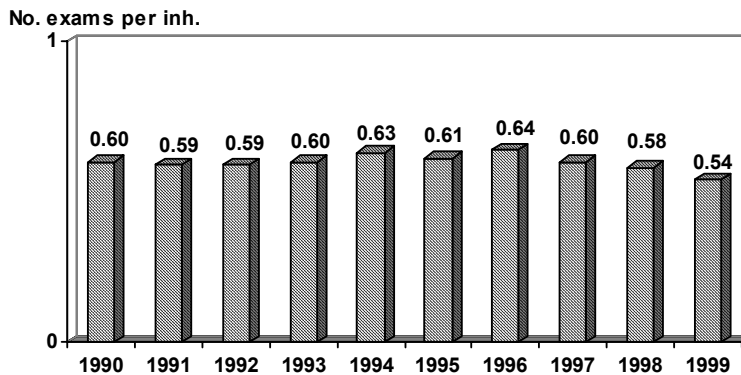


Fig. 3 Number of X-ray examinations per head of population (1990-1999)

The relative frequencies of different types of X-ray examinations estimated

for 1990-1999 are compared in table 2.

Table 2. Relative frequencies of X-ray examinations (1990-1999)

Examination type	1990		1995		1999		1999/1990 ratio
	no	%	no	%	n	%	
TOTAL/y/10 ³ inh.	495	100	614	100	546	100	1.10
Fluoroscopy:	178	35.9	173	28.1	137	25.0	0.76
- thorax	115	23.2	118	19.2	109	19.9	0.95
- gastrointestinal tract	63	12.7	55	8.9	28	5.1	0.44
Radiographs:	182	36.8	342	55.8	337	61.9	1.85
- head	21	4.3	31	5.1	30	5.5	1.42
- dental (conv.+panoramic)	31	6.3	41	6.6	28	5.1	0.90
- thorax	24	4.9	64	10.4	66	12.0	2.75
- spine	21	4.2	39	6.3	38	7.0	1.80
- pelvis	13	2.6	15	2.4	20	3.6	1.53
- extremities	44	8.9	92	14.9	87	15.9	1.97
- mammography (dg)	2	0.4	4	0.6	9	1.6	4.50
- lung tomography (conv.)	4	0.8	9	1.4	5	0.9	1.25
- cholecistography	7	1.4	23	3.7	19	3.4	2.71
- i.v.urography	12	2.4	11	1.7	11	2.0	0.91
- cerebral angiography	2	0.4	2	0.3	2	0.3	1.00
Computed tomography	1	0.2	11	1.7	22	4.0	22.00
Photofluorography	135	27.3	99	16.1	72	13.1	0.53

CT is the examination showing the largest increase in frequency since 1996 (1.30% of total exams in 1996; 1.88% in 1997; 2.53% in 1998). The conventional examinations such as spine and mammography show a much smaller increase.

35 CT scanners have been installed between 1990 and 1995 (8). After this period the number of districts with CT scanners operating increased (table 3). Over 70% of CT scanners are functioning in the central, northwest and west regions, whereas in northeastern territory, only one district

(Iasi) has such imaging devices. However, in Romania, the health care is organized on regional basis with a districtual population ranging from 5×10^5 to 8×10^5 people. So, the age and sex distribution of population, nor the disease pattern could explain this map of CT scans. Significant socio-economic differences exist between these regions, as the gross domestic product indicates (5). As table 3 shows, the GDP ranged from 14.2 to 26.9 bill, higher than eastern (Iasi) GDP value.

Table 3. Regional breakdown of CT workload (thousands) and CT relative frequencies

Year District	1998 GDP/head (million lei*)	1996		1997		1998		1999	
		no	%	no	%	no	%	no	%
Arges	14.2	-	-	1,8	0.53	1.8	0.59	2.2	0.77
Bihor	15.6	-	-	-	-	3.2	0.96	1.8	0.51
Cluj	15.6	189.6	28.56	181.1	28.42	182.3	28.00	145.4	24.34
Constanta	14.2	5.7	1.39	6.9	1.44	9.1	1.98	9.2	(2.48)
Dolj	14.8	4.0	1.07	6.2	1.65	5.4	1.59	4.8	1.41
Iasi	12.6	5.9	1.0	4.9	0.98	no functioning		no functioning	
Maramures	15.6	1.6	0.46	4.7	1.46	5.0	1.59	4.3	1.42
Mures	17.7	75.7	13.08	106.2	18.78	90.0	16.42	78.1	16.00
Sibiu	17.7	-	-	-	-	92.5	13.22	99.7	18.38
Timis	17.3	4.3	0.97	6.9	1.51	6.3	1.52	2.5	0.67
Bucuresti	26.9	91.6	4.73	123.3	6.36	140.6	6.96	134.4	6.51

*) Romanian currency

The CT scans usage differs widely between districts, as table 3 data indicate. The relative frequency of CT of total X-ray examinations in some districts raised after 1996, while there are districts with CT relative frequencies under 1%.

Is this due to the particular specialized hospitals obviously functioning in the university cities? Or to better

economic conditions? We have not yet a clear response.

To illustrate how this relatively new technology influenced the annual diagnostic radiology pattern (table 4) in four districts (two in northwest and central region vs. two in northeast region) the relative frequencies of X-ray examinations during 1999 have been analyzed.

Table 4. The relative frequencies of X-ray examinations (1999)

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Examination \ Districts	Northwest region	Central region	Northeast region	
	Cluj	Mures	Vaslui	Bacau
Fluoroscopy:	18.92	14.29	23.55	33.24
- thorax	16.71	11.85	21.15	28.54
- gastrointestinal tract	2.21	2.44	2.40	4.70
Radiography:	81.08	85.71	76.45	66.76
- head	3.78	4.93	5.31	6.28
- dental	6.19	7.47	4.69	12.65
- thorax	13.65	15.47	14.24	9.31
- spine	7.05	7.06	4.11	6.41
- pelvis	3.67	3.38	1.67	2.48
- extremities	12.74	17.92	16.17	21.51
- mammography	1.55	0.67	0.08	0.11
- tomography (lung)	0.35	0.76	0.69	2.47
- cholecistography	2.65	2.76	3.70	1.56
- i.v.urography	1.84	2.63	0.53	1.57
- angiography	0.67	0.27	-	-
Comp. tomography	24.34	16.00	-	-
- head	9.86	8.37	-	-
- body	14.48	7.63	-	-
Photofluorography	2.60	6.39	25.34	2.41

Significant differences in radiodiagnostic pattern appear.

As table 4 shows, fluoroscopic examinations performed in health care units from center or west parts of Romania are held down to 14-19% of all examinations, as well as the photofluorographies. Meantime, the radiological pattern in eastern regions registered large relative frequencies of fluoroscopies (up to 33%) or photofluorographies which in some districts exceeds the mean value for whole country of 14% (1999).

The steady growth in CT must be very carefully considered. The increase of the number of CT examinations of totals X-ray examinations may have partially held down the numbers of some conventional procedures but this fact is evident only in some districts.

However CT while providing far better diagnostic information involve substantially higher doses than the conventional examinations.

So, using such technology as CT means a double justification by careful selection of patients whose clinical benefits should counterbalance both the radiation risks involved and financial effort.

CONCLUSIONS

1) Although, during 1990-1999, the total annual number of medical X-ray examinations per head of population has remained substantially constant some differences in the relative frequencies of procedures become evident.

2) New imaging technologies as CT have begun to make a significant

contribution in radiological practice in some regions (up to 24%), although, at national level in 1999 had only relative frequency of 4% of the total X-ray examinations.

3) The usage of such technology seems unjustified in some districts as the relative frequencies of CT show, asking for a more responsible attitude both for patient protection and financial resources.

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