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PROFESSIONAL EDUCATION IN MAMMOGRAPHY: A STUDY OF MAMOGRAPHICS SERVICES OPERATING IN THE STATE OF RIO DE JANEIRO, WITH EMPHASIS ON SUS (UNIFIED HEALTH SYSTEM)

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Abstract: Mammography is the most effective imaging diagnosis for early detection of changes in the breasts capable of causing cancer, even small ones that go unnoticed during self-examination. Mammographs are of the conventional type (simple control), computerized or with stereotaxy, that is, when they have accessories for biopsies. Mammography in the SUS (Unified Public System of the Brazilian Federation) is considered the most relevant method for recording the rate of breast cancer, therefore, it is necessary to improve the level of diagnosis in Brazil. The objective of this work was to distribute mammograms throughout the state of Rio de Janeiro (RJ), identifying those that are affiliated with the SUS (Unified Health System), with a view to understanding the employability of graduates from courses in this modality. The methodology involved surveying the three types of mammograms available on the DATASUS website. Simultaneously, a spreadsheet was created for each type of mammography with this information: establishment, business name, neighborhood, municipality, state, establishment management, existing and in-use equipment, SUS (Unified Health System) and last update. The results obtained showed that there are 553 mammography machines and 531 are in operation in the state of RJ. Of the operating devices that offer the exam through the SUS agreement, it was 34%. It is concluded that 73% of this equipment is concentrated in the following municipalities: Rio de Janeiro, Niterói, São Gonçalo, Macaé, Campos dos Goytacazes, Nova Iguaçu, Duque de Caxias, Petrópolis, São João de Meriti, Belford Roxo and Volta Redonda. Considering only the establishments that have an agreement with the SUS (Unified Health System), 58% are located in Rio de Janeiro, São Gonçalo, Campos dos Goytacazes, Belford Roxo, Nova Friburgo, Nova Iguaçu, Niterói, Magé and Itaperuna.

Keywords: Mammography, professional education, SUS (Unified Health System)

INTRODUCTION

According to the National Cancer Institute (INCA) (2018), breast cancer is the most common in women in the world and in Brazil, second only to non-melanoma skin cancer, accounting for 28% of cases. new per year. It rarely affects men, around 1% of all cases of this disease. In this scenario, performing a mammography exam can save many lives, especially patients in whom the lesion is not yet palpable, as mammography is the best imaging diagnostic test for detecting breast cancer (FENAPAS, 2017).

This examination is carried out using a mammograph, a device that compresses the breasts in order to obtain a detailed image of the region, making it possible to diagnose microcalcifications, nodules, asymmetries and changes in the breast tissue (MINUTO SAUDÁVEL, 2017). Mammographs are of the conventional type (simple control), computerized or with stereotaxy, that is, when they have accessories for biopsies.

Mammography in the SUS (Unified Health System) is considered the most relevant method for recording the rate of breast cancer, therefore, it is necessary to improve the level of diagnosis in Brazil, where some cities have more advantages than others (HEALTH OBSERVATORY, 2016). According to ``*Portal Brasil*`` (2016), the SUS (Unified Health System) guarantees the provision of mammography exams for women of any age group, as long as they have a medical recommendation. Given the importance of mammograms, it is important to know their distribution in the state of Rio de Janeiro (RJ) and also which municipalities offer this exam through the SUS (Unified Health System), since the entire population must have easy and free access to this service. Within this context, it is worth highlighting the paramount importance of professional education in this modality and the employability opportunities of its graduates.

GOAL

The objective of this work was the distribution of mammography devices throughout the state of Rio de Janeiro, identifying those that are affiliated with the SUS (Unified Health System), with a view to understanding professional education, with regard to the employability of graduates from courses in this branch of radiology.

DEVELOPMENT

THE HISTORY OF MAMMOGRAPHY

The German Albert Salomon performed the first breast x-rays in 1913, on surgical specimens extracted from mastectomy operations, becoming a pioneer in the study of breast lesions. A few years later, in New York, a radiologist named Stamford Warren performed the first mammogram in the mediolateral view. In 1960, Raul Leborgne, a Uruguayan radiologist, discovered that compression was extremely important for breast examinations, as it reduced the thickness of the breast, reducing the dose of radiation to the patient (SILVA, G.P. et al, 2012).

As it can be seen in Figure 1, the first device to study breast tissue was created in 1966, by the company General Electrics (GE), which was a special camera supported by a tripod, having undergone many improvements, it started to present images of great quality for the time. In 1980, GE also created special devices for breast compression, known worldwide as mammography (CASTRO, M.T. et al, 2017).
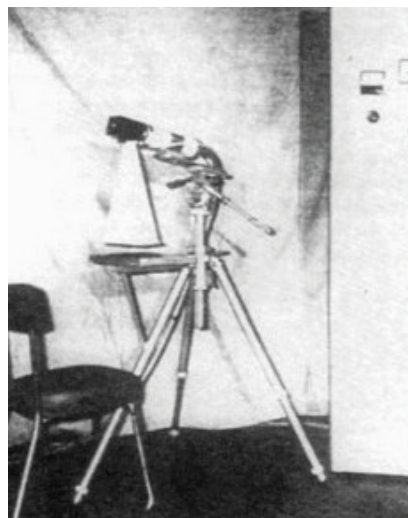

Figure 1: First device manufactured by GE.

Source: RADIO IN MAMA, 2018.

The Brazilian Institute for Cancer Control (IBCC) were responsible for bringing the first mammography machine to Brazil in 1971, marking a major step forward in mastology in the country, demonstrated in Figure 2 (MAXIM, 2016).

Figure 2: First mammogram brought to Brazil by IBCC.

Source: RADIO IN MAMA, 2018.

These were some historical milestones that contributed to the study and diagnosis of breasts, which have increasingly undergone improvements.

MAMMOGRAM

Mammography is the most effective imaging diagnosis for early detection of changes in the breasts capable of generating cancer, even small ones that go unnoticed during self-examination (SOUSA, 2016). Low kilovoltage (kV) and high milliampere per second (mAs) are used to better identify breast structures, which have similar density, thus generating a high contrast (FERNANDES, 2015).

To guarantee the performance of mammography, the image obtained must be of high quality and, to this end, the following are necessary: adequate equipment, correct radiological technique, knowledge, practice and dedication of the professionals involved (INCA, 2007, p. 13).

Besides, according to Inca (2007), currently the use of high-resolution mammographs equipped with a fine focus for magnification, combining film/screen appropriately and intrinsic processing has offered a greater number of detections of breast lesions, especially those that are not palpable due to the size.

According to the National Health Surveillance Agency (ANVISA) (1998), through ordinance 453, some of the technical requirements for mammography machines are: three-phase or high-frequency generator, suitable compression device (compression force between 11 and 18 kgf), distance focus-skin cannot be less than 30 cm, focal spot size must not be more than 0.4 mm and tube specially designed for mammography (with beryllium window).

CONVENTIONAL MAMMOGRAPHY

In conventional or analog mammography, image registration is the combination of mono-emulsified film-screen to reduce radiation dose and degradation of spatial resolution. Due to this characteristic of radiographic film, which makes the film more sensitive compared to others used in conventional radiography, film processing ends up being slower. The image formed is visualized on the radiographic film (ALMEIDA, C. et al, 2008).

For Maranhão (2006), some of the limitations of conventional mammography are the fact that it cannot alter the image after processing, requiring a new exposure for clarification, the fragility of under or overexposure, slow processing and the possibility of artifacts in the image, standardizing image quality is difficult, due to film/screen/processing combinations and, lastly, the likelihood of loss or damage to the diagnostic document.

COMPUTERIZED MAMMOGRAPHY

In digital imaging systems, an imaging plate (IP) replaces radiographic films, demonstrated in Figure 3. Such receivers capture the image and are later sent for viewing on a computer monitor, which has qualities, such as example: high resolution, possibility of printing the image (FURQUIM, T.A.C, 2018).
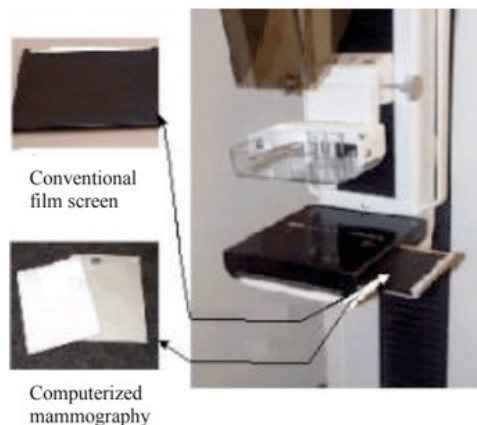

Figure 3: Mammography equipment can be adapted with film-screen or IP.

Source: FURQUIM, T.A.C, 2018

The advantage of the digital system is that there is the possibility of manipulating images with resources such as zoom, measuring the lesion, varying the contrast and transmitting

them for evaluation by other specialists (FURQUIM, T.A.C, 2018).

In computerized mammography, the device is the conventional mammograph from which the image is obtained, only the chassis is digital. This chassis does not have film, the image is "scanned" on an appropriate "scanner", thus acquiring a computerized image, which can be read on a monitor or printed on film (MARANHÃO, N. et al, 2006).

STEREOTACTIC MAMMOGRAPHY

The stereotaxy technique is used to accurately locate a suspicious lesion in the breast, when it can only be seen through mammography. From ampulla angulations at 15º, two mammographic views are performed (ALMEIDA, C. et al, 2008).

According to Figure 4, digital stereotaxis is equipment with specific capacity to locate the area to be biopsied, with x-rays at different angles it is possible to know exactly the change in the tissue (``CLÍNICA DA MAMA``, 2015)

During the entire examination, the breast is compressed and the plate that compresses it has a hole that allows the needle to pass through to remove a tissue sample, which will indicate whether the cellular changes are benign or malignant (ALMEIDA, C. et al, 2008).

According to radiologist Vivian Schivartche, a specialist in breast cancer diagnostics at ``Centro de Diagnósticos Brasil`` (CDB), in São Paulo: "Nowadays, patients have cutting-edge diagnoses. The procedure that is guided by stereotaxy (mammography) is carried out in a clinic or outpatient clinic, is painless, there is no need for hospitalization, using local anesthesia, leaves practically no anesthesia and removes a lot of material from the lesion" (``DIÁRIO DO LITORAL``, 2014).

Based on information from the aforementioned radiologist, until a few years ago the patient was subjected to a surgical procedure to remove the lesion and analyze the nodule, that is, to analyze whether it was benign or malignant. She was hospitalized for two or three days and consequently had a scar. If the diagnosis was malignant, another surgery was performed to remove the tissue around the tumor (``DIÁRIO DO LITORAL``, 2014).

According to Furquim (2018), mamographic equipment that has a stereotactic accessory allows biopsy to be performed. It can be done in two ways: fine needle aspiration (FNA), in the case of liquid material and for solid material it is called core biopsy, shown in Figure 5.
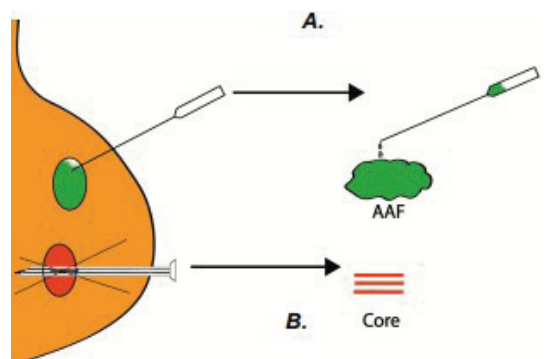

Figure 4: Performing mammography with stereotaxy.

Source: ``CLÍNICA DA MAMA``, 2015

Figure 5: Diagram showing biopsy. **A** - AAF and **B** - *Core*.

Source: FURQUIM, T.A.C, 2018

DATASUS PLATFORM

According to ANVISA (1998), chapter 3 of Ordinance 453 provides that all diagnostic X-ray devices and their components, such as: head, collimator, bucky (wall or table), tube, image intensifier and accessories of radiological protection in radiodiagnosis, must not be sold without being registered with the Ministry of Health.

Suppliers of diagnostic x-ray equipment must inform each state health authority in writing every six months about each piece of equipment sold to be installed in the respective state, including its serial number, in order to allow traceability of equipment installed in the country (ANVISA, 1998, p. 7).

This equipment can be tracked by the National Registry of Health Establishments (CNES), which aims to make Health Information Systems operational (DATASUS, 2018).

The CNES is a system of the Department of Informatics of the Unified Health System (DATASUS), created in 1999. The Ministry of Health (MS)/Secretary of Health Care (SAS) established the establishment registration forms and initiated a public consultation. In 2000, the MS/SAS approved the establishment registration form and its manuals, ordering DATASUS to create the national database of healthcare establishments. Its target audience is public health establishments, complementary network and providers of the (Unified Health System - SUS), which can be individuals or legal entities (DATASUS, 2018).

METHODOLOGY

To carry out this study, data was collected by DATASUS regarding the number of mammography machines with the three types available on the website, such as: simple control, computerized and stereotaxy existing in the state of Rio de Janeiro, as shown in Figure 6.

As it was shown in Figure 7, some data considered relevant to the objective of the work were collected through the website. Simultaneously, a spreadsheet was created for each type of mammography with this information: establishment, business name, neighborhood, municipality, state, management of the establishment (municipal or state), existing equipment and in use, whether they are operating in the SUS (Unified Health System) and latest update, as shown in Figure 8.

RESULTS

After analyzing all the data obtained, the results discussed below were possible. The total number of mammography equipment was 553 existing and 531 in operation in the state of RJ. The division according to each type of mammography was in simple command with 402 and 384 in use, computerized with 70 existing and the same active quantity and stereotaxy there are 81 and 77 in functionality, as shown in Graphic 1.
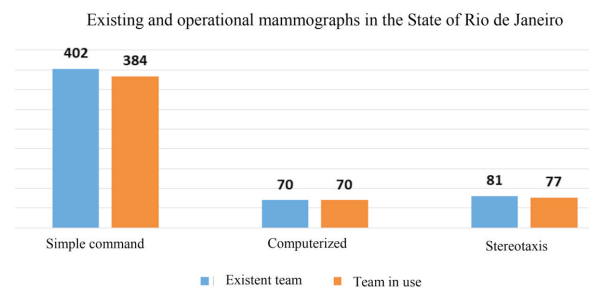
Graphic 1: General quantity of the three types of mammograms available in the DATASUS system.

According to mammography services that have devices in operation and that offer the exam through the SUS agreement, it was 34%, while establishments that do not offer these exams for free were 66%, this information is shown in Graphic 2.

CNES	Establishment	City	Existent	Under use	SUS
2297523	ABRAE	SAO GONCALO	1	1	S
7973306	ALTA BARRA SHOPPING	RIO DE JANEIRO	1	1	N
9304061	ALTA LEBLON DIAGNOSTICOS	RIO DE JANEIRO	1	1	N
3471314	AMACOR SERVICOS MEDICOS CAMPO GRANDE	RIO DE JANEIRO	1	1	N
9119957	AMBULATORIO SAO LUIZ GONZAGA	RIO DE JANEIRO	1	1	N
7230362	AMEG ASSISTENCIA MEDICA GUARATIBA	RIO DE JANEIRO	1	1	N
2778580	AMIS	DUQUE DE CAXIAS	1	1	S
7698313	AMO RX	RIO DE JANEIRO	1	1	S
5184932	AMO ULTRA SOM	RIO DE JANEIRO	1	1	S
6403859	ASSOCIACAO AMOR E VIDA	ITAGUAI	1	1	N
5159636	ASSOCIACAO DE APOIO A TERCEIRA IDADE CENTRO	RIO DE JANEIRO	3	3	N
5329159	ASSOCIACAO DE APOIO A TERCEIRA IDADE TIJUCA 2	RIO DE JANEIRO	2	2	N
6649106	BAYAO DIAGNOSTICOS MEDICOS	NITEROI	1	1	N
3030415	BENEFICENCIA PORTUGUESA DE PETROPOLIS	PETROPOLIS	1	1	N
6833438	BR	TRES RIOS	1	1	N
6987346	BRONSTEIN BOTAFOGO II	RIO DE JANEIRO	1	0	N
3383059	BRONSTEIN MED DIAG CENTRO I	RIO DE JANEIRO	1	1	N
3382133	BRONSTEIN MED DIAG MEIER II	RIO DE JANEIRO	1	1	N
6987400	BRONSTEIN MEGA CAMPO GRANDE	RIO DE JANEIRO	1	1	N
3383067	BRONSTEIN MEGA COPACABANA	RIO DE JANEIRO	1	1	N
6987516	BRONSTEIN POLO I	RIO DE JANEIRO	1	1	N
7442548	CADI DIAGNOSTICO	CASIMIRO DE ABREU	1	1	S
7011547	CADI DIAGNOSTICOS	ARMACAO DOS BUZIOS	1	1	N
3958035	CARDIO CENTER RESENDE	RESENDE	1	1	N
2287919	CASA DE CARIDADE SANTA RITA	BARRA DO PIRAI	1	1	S
3113205	CASA DE PORTUGAL	RIO DE JANEIRO	1	1	N

Figure 6: CNES page with RJ's simple-to-control mammography equipment.

Source: CNES, 2018.


Figure 7: Page with information about the establishment that has simple-to-control mammographs in RJ.

Source: CNES, 2018.

CNESNET – National Registry of healthcare establishments; Mammography with simple control

| Establishment	Business name	District	City	State	Establishment			SUS	Last update
ABRAE	ASSOCIAÇÃO BRASILEIRA DE ASSISTÊNCIA AO EXCEPCIO	CENTRO	SÃO GONÇALO	RJ	Municipal	1	1	Sim	12/12/2017
ALTA BARRA SHOPPING	DIAGNOSTICOS DA AMERICA S A	BARRA DA TIJUCA	RIO DE JANEIRO	RJ	Municipal	1	1	Não	12/12/2017
ALTA LEBLON DIAGNOSTICOS	DIAGNOSTICOS DA AMERICA S A	LEBLON	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
AMACOR SERVICOS MEDICOS CAMPO GRANDE	AMACOR SERVICOS MEDICOS LTDA	CAMPO GRANDE	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
AMBULATORIO SAO LUIZ GONZAGA	ASSOCIACAO DOS ANTIGOS ALUNOS DOS PADRES JESUI	BOTAFOGO	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
AMEG ASSISTENCIA MEDICA GUARATIBA	ASSISTENCIA MEDICA GUARATIBA LTDA	GUARATIBA	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
AMIS	ASSOCIACAO MEDICA INDEPENDENTE SOCIAL AMIS	CENTRO	DUQUE DE CAXIAS	RJ	Municipal	1	1	Sim	08/01/2018
AMO RX	AMO RX IMAGENS RIO RADIOLOGIA LTDA	BANGU	RIO DE JANEIRO	RJ	Municipal	1	1	Sim	08/01/2018
AMO ULTRA SOM	AMO SERVICOS MEDICOS LTDA	REALENGO	RIO DE JANEIRO	RJ	Municipal	1	1	Sim	08/01/2018
ASSOCIACAO AMOR E VIDA	ASSOCIACAO AMOR E VIDA	CENTRO	ITAGUAÍ	RJ	Municipal	1	1	Não	10/01/2018
ASSOCIACAO DE APOIO A TERCEIRA IDADE CENT	ASSOCIACAO DE APOIO A TERCEIRA IDADE	CENTRO	RIO DE JANEIRO	RJ	Municipal	3	3	Não	08/01/2018
ASSOCIACAO DE APOIO A TERCEIRA IDADE TIJUC	ASSOCIACAO DE APOIO A TERCEIRA IDADE	TIJUCA	RIO DE JANEIRO	RJ	Municipal	2	2	Não	08/0182018
BAYAO DIAGNOSTICOS MEDICOS	OS DE DIAGNOSTICOS MEDICOS COMPLEMENTARE	CENTRO	NITEROI	RJ	Municipal	1	1	Não	10/01/2018
BENEFICENCIA PORTUGUESA DE PETROPOLIS	SMH SOCIEDADE MEDICO HOSPITALAR LTDA	VALPARAISO	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
BR	BR SERVICOS RADIOLOGICOS LTDA	CENTRO	TRES RIOS	RJ	Municipal	1	1	Não	12/01/2018
BRONSTEIN BOTAFOGO II	DIAGNOSTICOS DA AMERICA S A	BOTAFOGO	RIO DE JANEIRO	RJ	Municipal	1	0	Não	08/01/2018
BRONSTEIN MED DIAG CENTRO I	DIAGNOSTICOS DA AMERICA S A	CENTRO	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
BRONSTEIN MED DIAG MEIER II	DIAGNOSTICOS DA AMERICA S A	MEIER	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018
BRONSTEIN MEGA CAMPO GRANDE	DIAGNOSTICOS DA AMERICA S A	CAMPO GRANDE	RIO DE JANEIRO	RJ	Municipal	1	1	Não	08/01/2018

Figure 8: Spreadsheet with all single-control mammography machines installed in RJ.

Source: Author's collection, 2018.

SERVICES LINKED OR NOT TO SUS
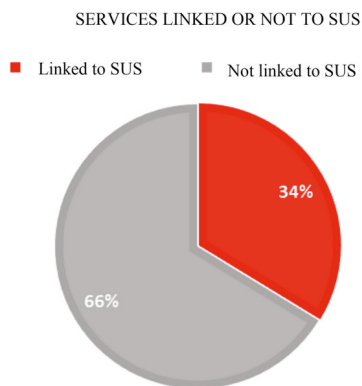
Graphic 2: Services with mammography machines in operation linked or not to the SUS.

These services were then divided by types of devices, their sample was 61% for simple command, 18% for computerized and 21% for stereotaxy, as shown in Graphic 3.

Mammographs operating in the SUS
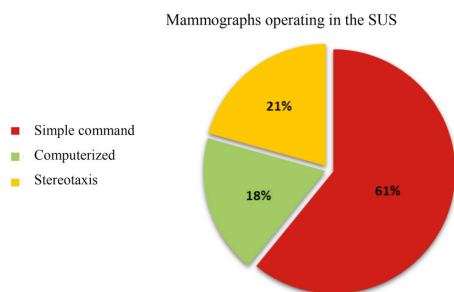
Graphic 3: Distribution by types of mammography machines operating in the SUS.

According to table 1, the distribution of mammography equipment in operation in all municipalities in the state of RJ and those that offer this technique through the SUS, showed that following respectively the number of mammography machines and the number through the SUS was: in the municipality of RJ with 209 and 45, Niterói com 32 and 5, São Gonçalo with 29 and 14, Macaé with 18 and none, Campos dos Goytacazes with 17 and 8, Nova Iguaçu with 17 and 6, Duque de Caxias with 16 and 2, Petrópolis with 15 and 4, São João de Meriti with 12 and 4, Belford Roxo with 11 and 8, Volta Redonda 11 and 4, Nova Friburgo with 10 and 8, Magé 9 and 5, Resende with 9 and 2, Angra dos Reis with 8 and 3, Nilópolis with 7 and 5, Itaperuna with 6 and 5, Barra Mansa and Itaboraí with 6 and 2, Três Rios com 6 and 1, Cabo Frio with 5 and 1, Itaguaí with 5 and none, Rio das Ostras, Araruama e Barra do Piraí with 4 and 3, Teresópolis with 4 and 2, Cachoeira de Macacu and Paracambi with 3 and 3, Vassouras, Guapimirim and Bom Jesus de Itabapoana with 3 and 2, Armação dos Búzios with 3 and none, Saquarema and Valença with 2 and 2, Rio Bonito, São Francisco de Itabapoana,

Paraíba do Sul and São Fidélis with 2 and 1, Maricá and Santo Antônio de Pádua with 2 and none, Casimiro de Abreu, Queimados, Mangaratiba, Itatiaia, Porto Real, Mesquita, São Pedro da Aldeia, Miguel Pereira, Iguaba Grande, Carmo, São José do Vale do Rio Preto, Cordeiro, Itaocara and Mendes with 1 and 1, Arraial do Cabo, Miracema and Conceição de Macabu with 1 and none.

Cities	Simple command(SUS)	Computerized(SUS)	Stereotaxis(SUS)
Rio de Janeiro	142 (18)	37 (11)	30 (16)
Campos dos Goytacazes	12 (5)	1 (1)	4 (2)
Duque de Caxias	13 (2)	2 (0)	1 (0)
Niterói	26 (4)	3 (0)	3 (1)
Macaé	15 (0)	0 (0)	3 (0)
Cabo Frio	3 (0)	0 (0)	2 (1)
São Gonçalo	26 (12)	1 (1)	2 (1)
Rio das Ostras	4 (3)	0 (0)	0 (0)
Nova Iguaçu	15 (4)	0 (0)	2 (2)
Petrópolis	10 (2)	0 (0)	5 (2)
Maricá	1 (0)	1 (0)	0 (0)
Volta Redonda	9 (4)	0 (0)	2 (0)
Itaguaí	4 (0)	0 (0)	1 (0)
Angra dos Reis	5 (2)	1 (1)	2 (0)
São João de Meriti	9 (3)	2 (0)	1 (1)
Resende	8 (1)	1 (1)	0 (0)
Belford Roxo	6 (3)	5 (5)	0 (0)
Barra Mansa	5 (2)	1 (0)	0 (0)
Itaboraí	5 (2)	0 (0)	1 (0)
Teresópolis	2 (1)	1 (1)	1 (0)
Armação dos Búzios	3 (0)	0 (0)	0 (0)
Nova Friburgo	2 (1)	4 (4)	4 (3)
Casimiro de Abreu	1 (1)	0 (0)	0 (0)
Queimados	1 (1)	0 (0)	0 (0)
Magé	7 (4)	1 (1)	1 (0)
Três Rios	3 (1)	1 (0)	2 (0)
Mangaratiba	1 (1)	0 (0)	0 (0)
Itatiaia	0 (0)	1 (1)	0 (0)
Nilópolis	5 (3)	0 (0)	2 (2)
Porto Real	0 (0)	1 (1)	0 (0)
Itaperuna	3 (3)	0 (0)	3 (2)
Mesquita	0 (0)	0 (0)	1 (1)
Araruama	2 (1)	1 (1)	1 (1)
Saquarema	2 (2)	0 (0)	0 (0)
Barra do Piraí	4 (3)	0 (0)	0 (0)
São Pedro da Aldeia	1 (1)	0 (0)	0 (0)
Valença	2 (2)	0 (0)	0 (0)
Rio Bonito	1 (0)	1 (1)	0 (0)
Arraial do Cabo	1 (0)	0 (0)	0 (0)

São Francisco de Itabapoana	2 (1)	0 (0)	0 (0)
Itaocara	0 (0)	0 (0)	1 (1)
Santo Antônio de Pádua	2 (0)	0 (0)	0 (0)
Cachoeira de Macacu	2 (2)	1 (1)	0 (0)
Paraíba do Sul	1 (1)	0 (0)	1 (0)
Vassouras	3 (2)	0 (0)	0 (0)
Guapimirim	0 (0)	3 (2)	0 (0)
Paracambi	3 (3)	0 (0)	0 (0)
São Fidélis	2 (1)	0 (0)	0 (0)
Miguel Pereira	1 (1)	0 (0)	0 (0)
Bom Jesus de Itabapoana	2 (1)	0 (0)	1 (1)
Miracema	1 (0)	0 (0)	0 (0)
Iguaba Grande	1 (1)	0 (0)	0 (0)
Carmo	1 (1)	0 (0)	0 (0)
São José do Vale do RioPreto	1 (1)	0 (0)	0 (0)
Cordeiro	1 (1)	0 (0)	0 (0)
Conceição de Macabu	1 (0)	0 (0)	0 (0)
Mendes	1 (1)	0 (0)	0 (0)

Table 1: Operating and offering mammography machines in the SUS in the municipalities of the state of Rio de Janeiro.

CONCLUSION

The study showed the existence of 553 mammography machines (402 are simple control, 70 are computerized and 81 are stereotaxic), 531 of which are in operation (384 are simple control, 70 are computerized and 77 are stereotaxic) throughout the state of Rio de Janeiro, of which only 34% are linked to the SUS.

A total of 73% of this equipment is concentrated in the following municipalities: **Rio de Janeiro (209); Niterói (32); São Gonçalo (29); Macaé (18), Campos dos Goytacazes (17), Nova Iguaçu (17), Duque de Caxias (16), Petrópolis (15), São João de Meriti (12), Belford Roxo (11) e Volta Redonda (11).** Considering only establishments that have an agreement with the SUS, 58% are located in **Rio de Janeiro (45), São Gonçalo (14), Campos dos Goytacazes (8), Belford Roxo (8), Nova Friburgo (8), Nova Iguaçu (6),** Niterói (5), Magé (5) and Itaperuna (5).

The graduated students who wish to be employed in mammography have more than 500 job opportunities in the state of Rio de Janeiro.

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