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ORIGINAL ARTICLE

Profile of patients with cervical cancer and their geographic access to health services in Rio de Janeiro, Brazil

Perfil de pacientes com câncer de colo do útero e seu acesso geográfico aos serviços de saúde no Rio de Janeiro, Brasil

Perfil de las pacientes con cáncer de cuello uterino y su acceso geografico a los servicios de salud en Rio de Janeiro, Brasil

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ABSTRACT

Explore the possible effects of the implementation of municipal (August 2013) and state (June 2015) regulatory systems on the sociodemographic and clinical characteristics of patients with cervical cancer and their geographical access. This is a retrospective interrupted time series analysis carried out in Brazil using the Rio de Janeiro state Hospital-Based Cancer Registry database. All individuals with cervical cancer registered in the Rio de Janeiro state Hospital-Based Cancer Registry from 2012 to 2017 were included. ITS analysis considered the implementation period of the regulation systems using a segmented linear regression model. Geographic access to health services was mapped using QGIS software to verify the distance traveled from the patient's place of residence to the treatment facility. A total of 3460 women were included. 69.81% were between 30 and 59 years old, and 28.12% had no staging information at diagnosis. Implementing regulation systems influenced geographic access to health services and distances traveled for treatment by patients with CC in Rio de Janeiro.

Keywords: Uterine cervical neoplasms; Health care coordination and monitoring; Time series analysis interrupted; Health services accessibility; Outcome assessment.

RESUMO

Explorar os possíveis efeitos da implementação dos sistemas regulatórios municipal (agosto de 2013) e estadual (junho de 2015) nas características sociodemográficas e clínicas de pacientes com câncer de colo do útero e no acesso geográfico aos serviços de saúde. Trata-se de uma análise retrospectiva de série temporal interrompida, utilizando o banco de dados do Registro Hospitalar de Câncer do estado do Rio de Janeiro, Brasil. Foram incluídas todas as pacientes com câncer de colo do útero registradas no período de 2012 a 2017. A análise de ITS considerou o período de implementação dos sistemas regulatórios, utilizando um modelo de regressão linear segmentado. O acesso geográfico aos serviços de saúde foi analisado por meio do software QGIS, a fim de verificar a distância percorrida entre o local de residência das pacientes e a unidade de tratamento. Um total de 3.460 mulheres foram incluídas no estudo, das quais 69,81% tinham entre 30 e 59 anos, e 28,12% não possuíam informações sobre estadiamento no momento do diagnóstico. A implementação dos sistemas regulatórios influenciou o acesso geográfico aos serviços de saúde e as distâncias percorridas para tratamento por pacientes com câncer de colo do útero no Rio de Janeiro.

Palavras-chave: Neoplasias do colo do útero; Regulação e fiscalização em saúde; Análise de séries temporais interrompida; Itinerário terapêutico; Avaliação de resultados em cuidados de saúde.

RESUMEN

Explorar los posibles efectos de la implementación de los sistemas regulatorios municipal (agosto de 2013) y estatal (junio de 2015) en las características sociodemográficas y clínicas de las pacientes con cáncer de cuello uterino y en su acceso geográfico a los servicios de salud. Se trata de un análisis retrospectivo de series de tiempo interrumpido, utilizando la base de datos del Registro Hospitalario de Cáncer del estado de Río de Janeiro, Brasil. Se incluyeron todas las pacientes con cáncer de cuello uterino registradas durante el período de 2012 a 2017. El análisis de ITS consideró el período de implementación de los sistemas regulatorios mediante un modelo de regresión lineal segmentado. El acceso geográfico a los servicios de salud se mapeó utilizando el software QGIS para analizar la distancia recorrida desde el lugar de residencia de las pacientes hasta el centro de tratamiento. Un total de 3.460 mujeres fueron incluidas en el estudio, de las cuales el 69,81% tenía entre 30 y 59 años, y el 28,12% no contaba con información sobre estadificación al momento del diagnóstico. La implementación de sistemas regulatorios influyó en el acceso geográfico a los servicios de salud y en las distancias recorridas para el tratamiento por parte de las pacientes con cáncer de cuello uterino en Río de Janeiro.

Palabras clave: Neoplasias cervicales; Regulación e inspección sanitárias; Análisis de series temporales interrumpidas; Itinerario terapêutico; Evaluación de resultado en la atención de salud.

ARTICLE INFORMATION

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All authors are responsible for the writing and critical review of the intellectual content of the text, for the final published version, and for all legal and scientific aspects related to the accuracy and integrity of the study.

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INTRODUCTION

In 2022, there were an estimated 661,021 new cases and more than 348,000 deaths from cervical cancer (CC) worldwide. Incidence rates are higher in low- and middle-income countries. It is the most commonly diagnosed cancer in 25 countries and the leading cause of cancer death in 37 countries. In South America, the incidence rates are 15.60 cases per 100,000 women (Bray *et al.,* 2024).

In Brazil, 17,010 new cases per year are expected for the period from 2023 to 2025. The yearly national incidence rate is estimated at 13.25/100,000. In the Southeast Region (12.73/100,000) CC is the fifth in incidence among women. In Rio de Janeiro State there are estimated to have been 1540 new cases per year during the same period, with 570 of those in the Municipality of Rio (Santos *et al.*, 2023). CC is highly preventable, and it can be cured if identified early. Despite this, the diagnosis, which is often performed in advanced stages, seems to be the main reason for ongoing high mortality rates (Renna Junior; Silva, 2018).

In Brazil, cancer care is delivered at specialized health care facilities that are geographically concentrated in the more populated areas. Therefore, understanding the geographic access of CC patients to health services can further support future interventions (Silva; O'Dwyer; Osorio-de-Castro, 2019).

Prior to the implementation of municipal and state regulatory systems in the city of Rio de Janeiro, specialized care was carried out on demand, with the patient being responsible for navigating the system themselves. Therefore, when the individual received a referral, they needed to go to the desired health facility and request a slot for the recommended procedure. This process increased patient travel costs, absences from work, and inequitable access. Furthermore, there were queues for scheduling and disputes over opportunities at specific healthcare facilities (Faria; Emmerick; Silva, 2022; Pinto *et al.*, 2017).

In order to organize the flow among the different hierarchical levels of care, improve management of appointments and treatment availability (Carroll; Gomide, 2020), municipal (August 2013) and state (June 2015) regulations were implemented. In Rio de Janeiro state individuals must arrive at the specialized care facility with a diagnosis and referral (Rio de Janeiro, 2015).

A single study that evaluated the effect of municipal and state regulation on access and outcomes for cervical cancer patients in Rio de Janeiro found that regulation had, to some extent, organized access flow for specialized care. However, other aspects of health care delivery should be addressed, such as an internal backlog at the institutions, which jeopardizes the timely start of treatment (Faria; Emmerick; Silva, 2022).

This paper aims to analyze the sociodemographic and clinical characteristics of patients with cervical cancer registered in the Hospital-Based Cancer Registry from 2012 to 2017 and their geographic access to health care in Rio de Janeiro, Brazil, considering the municipal and state regulations.

METHODS

This is a retrospective quasi-experimental study using interrupted time series (ITS) segmented linear regression. The interventions analyzed were the implementation of the municipal (August 2013) and state (June 2015) regulation system for the treatment of CC in the state of Rio de Janeiro.

The study included women with CC (ICD-10 – code C53), registered in the Hospital-Based Cancer Registry (HBCR) from January 2012 to December 2017, according to the date of the first consultation in specialized care. We made the methodological option of ending the analyzed period in 2017 because we aim to evaluate the changes that might have occurred in the short and medium term. Long-term effects are not in the scope of this manuscript.

The HBCR is a national public database with unrestricted access and is available for download. It contains 46 variables divided into socio-demographic, epidemiological and clinical data. To consolidate most of the HBCR, Brazil uses the SisRHC, a computerized data system developed and provided by the National Cancer

Institute (INCA). Databases are consolidated according to the year of the first consultation reported by the hospital. In order to compile the data, it is sent to the HBCR national base under the supervision of INCA through IntegradorRHC. The maintenance of HBCR and the routine uploading of data to Integrador RHC are mandatory actions for accredited high complexity cancer hospitals within the National Health System (SUS) and optional actions for non-accredited hospitals (Instituto Nacional de Câncer, [2019], 2022).

The database included the following variables: Median age at diagnosis, race/color, schooling, family history of cancer, history of alcohol consumption, smoking, marital status, Federative Unit (FU) and city of origin, the origin of referral, previous diagnosis/treatment, most important basis for diagnosis, detailed primary tumor location, presence of more than one tumor, clinical stage group (TNM), reason for not treating, first hospital treatment received, outcome after first treatment, hospital treatment unit, date of the first diagnosis, date of the first consultation in specialized care and date of the beginning of the treatment.

The data was systematized in Microsoft Excel 2013 and variables were organized in an order that favored their presentation and analysis. The details of how the variables were defined and re-categorized are presented in appendices 1 and 2. The Chi-square statistical test was performed for categorical variables and Kruskal Wallis for the ordinal variables in Stata version 17 software. A p-value < 0.05 was considered statistically significant.

In the few cases (3.5%) in which the date of the histopathological diagnosis was later than the date of the first consultation in specialized care, the date of the clinical diagnosis was considered, which corresponded to the date of the first specialist visit to tertiary care.

Missing and misclassified data accounted for 3% of total data and were excluded to avoid compromising the analysis.

The main outcomes for ITS were:

1. Median age of patients (MAP);
2. Percentage of people coming from the *Região Metropolitana* I (CRM);
3. Percentage of people referred by the public health system (PHS);
4. Percentage of cervical cancer patients meeting regulatory criteria (MRC), if the patient arrived at specialized care having already been diagnosed, but without having undergone any treatment they were considered to be compliant with regulation criteria and to have followed the appropriate flow;
5. Percentage of people with group I or II staging – early stage (PES);
6. Percentage of people who had surgery as their first treatment (SFT);
7. Percentage of people with a positive outcome (PPO). The outcomes after the first treatment were categorized as: “positive” (stable disease, partial and total remission) and “negative” (disease progression, therapeutic support, and death);
8. Percentage of people treated at the INCA (PTI).

The date of the first specialist visit was categorized according to the month and year of consultation.

A total of 28.18% of clinical staging values were missing. To deal with the missing data for this variable we performed a random imputation considering the stage distribution at each time point.

To analyze the impact of the implementation of the municipal and state regulation system for the treatment of CC in the state of Rio de Janeiro, ITS segmented linear regression models (Fretheim *et al.*, 2013, 2015; Linden, 2015, Wagner *et al.*, 2002, Zhang *et al.*, 2009) were used to determine the effect of system changes on the selected indicators. Estimating the effects, the ITS models adjust to preexisting tendencies

in the period before the intervention (Wagner *et al*., 2002). Segmented linear regression models were built using the "prais, corc" command in STATA v12 (Linden, 2015), analyzing linearity and autocorrelation.

The ITS models included three segments, baseline (January 2012 to July 2013), period after municipal regulation (January 2014 to May 2015), and after state regulation (January 2016 to December 2017). We excluded the following periods from the analysis, considering them as implementation phases. Municipal regulation from August to December 2013 and for the state regulation from June to December 2015. The implementation phase was longer for the state level because we accounted for the complexity of coordinating multiple municipalities and their administrative levels (Carroll; Gomide, 2019; Faria; Emmerick; Silva, 2022).

The segmented model is specified as follows (Linden, 2015, Wagner *et al*., 2002, Zhang *et al*., 2009, Zhang; Wagner; Ross-Degnan, 2011):

$$Yt = \beta0 + \beta1*montht + \beta2*intervention1t + \beta3*months\ after\ intervention1t + \beta4*intervention2t + \beta5*\ months\ after\ intervention2t + et$$

Where, time (t) is a continuous variable that indicates the time in months since the beginning of the observation period; Yt = result variable in month t; β0 = level at the beginning of the observation period (interruption); β1 = baseline tendency; months = number of months since the beginning of the observation; β2 = level change after municipal regulation; intervention1t = if montht is after the municipal regulation; β3 = tendency change after municipal regulation; β4 = level change after state regulation; intervention2t = if montht is after state regulation; β5 = tendency change after state regulation and et = residual error.

The baseline segment was adjusted with two interruptions and two variable estimation tendencies. The effect of changes in the system was estimated by one variable that represents the change in the level of the result immediately after the interventions and a second one that represents the change in the tendency of the post-intervention segment. Thus, the period of post-implementation of interventions was defined as being from August to December 2013 for municipal regulation and from June to December 2015 for state regulation. These periods were excluded from ITS models to estimate stable post-intervention effects. In addition, a sensitivity analysis was performed considering the possibility of autocorrelation, evaluating the significance of the Durbin-Watson statistics. The "prais, var rhotype (dw)"(Linden, 2015) procedure presented the best fit. The sensitivity analysis revealed that the small autocorrelation did not affect the direction and significance of the findings. All parameters were included in the models, regardless of their statistical significance. To summarize the effects of the intervention, estimates of the relative changes for December 2017 were calculated.

The geographic access to health services was traced to verify the displacement from the city of origin to the place of treatment using the QGIS software version 2.1.8. The mean travel distance for patients who were treated outside their region of origin was also calculated.

This study was carried out using information publicly available therefore is considered to not be subject to the Research Ethics Committee review.

RESULTS

A total of 3,460 women were included in the study. Most were in the age group of 30 to 59 years old, declared themselves "*pardo*" had elementary schooling, did not consume alcoholic beverages regularly, were not smokers, had the marital status registered as single, and were from the *Região Metropolitana I* of the state of Rio de Janeiro and were referred for treatment through a public health facility (Table 1).

Staging information, according to the TNM classification, was not available at the time of registration for 973 patients (28.12%). A total of 288 patients (8.5%) reported the main reason for discontinuing treatment was the clinical condition or the advanced stage of the disease. The combination of radiotherapy and chemotherapy was the main therapeutic modality used to treat women with CC in the analyzed periods.

After the first treatment, most patients had some clinical outcomes classified as favorable. Most patients were treated at the same health facility. The clinical characteristics of the study population are shown in table 1.

Table 1 – Sociodemographic and clinical characterization of women with cervical cancer from 2012 to 2017, in the state of Rio de Janeiro, Brazil

(continua)

Variable	Before regulation (Jan/12 a Jul/13)	After municipal regulation (Jan/14 a May/15)	After state regulation (Jan/16 a Dec/17)	Total	
	n (%)	n (%)	n (%)	n (%)	p-value
Age					0·06
18 – 29 years old	82 (6·84)	78 (7·57)	109 (8·86)	269 (7·77)	
30 – 59 years old	837 (69·81)	743 (72·07)	872 (70·89)	2452 (70·87)	
60 – 79 years old	249 (20·77)	187 (18·14)	213 (17·32)	649 (18·76)	
≥ 80 years old	30 (2·50)	21 (2·04)	36 (2·93)	87 (2·51)	
Unknown	1 (0·08)	2 (0·18)	0	3 (0·09)	
Race/color					<0·01
"*Pardo*"	466 (38·86)	451 (43·74)	574 (46·67)	1491 (43·09)	
White	505 (42·12)	411 (39·86)	501 (40·73)	1417 (40·95)	
Black	161 (13·43)	145 (14·06)	124 (10·08)	430 (12·43)	
Others/Unknown	67 (5·59)	24 (2·34)	31 (2·52)	122 (3·53)	
Education					<0·01
None	35 (2·92)	28 (2·72)	51 (4·14)	114 (3·29)	
Elementary school	667 (55·63)	528 (51·21)	548 (44·55)	1743 (50·38)	
High school	268 (22·35)	270 (26·19)	358 (29·11)	896 (25·90)	
Higher education	69 (5·75)	63 (6·11)	84 (6·83)	216 (6·24)	
Unknown	160 (13·35)	142 (13·77)	189 (15·37)	491 (14·19)	
Alcohol consumption					< 0·01
No	873 (72·81)	707 (68·57)	753 (61·22)	2333 (67·43)	
Yes	162 (13·51)	174 (16·88)	317 (25·77)	653 (18·87)	
Unknown	164 (13·68)	150 (14·55)	160 (13·01)	474 (13·70)	
Smoking					0·58
No	648 (54·05)	570 (55·29)	672 (54·63)	1890 (54·62)	
Yes	401 (33·44)	320 (31·04)	407 (33·09)	1128 (32·61)	
Unknown	150 (12·51)	141 (13·67)	151 (12·28)	442 (12·77)	
Marital status					< 0·01
Single	521 (43·45)	522 (50·63)	780 (63·41)	1823 (52·69)	
Married/Civil union	476 (39·70)	390 (37·83)	341 (27·72)	1207 (34·68)	
Divorced	113 (9·42)	88 (8·53)	85 (6·92)	286 (8·37)	
Unknown	89 (7·43)	31 (3·01)	24 (1·95)	144 (4·26)	
Geographic location					< 0·01
Metropolitana I	754 (62·89)	681 (66·05)	902 (73·34)	2337 (67·54)	
Metropolitana II	136 (11·34)	95 (9·22)	126 (10·24)	357 (10·32)	
Others/Unknown	309 (25·77)	255 (24·73)	202 (16·42)	766 (22·14)	
Referral source					< 0·01
SUS	883 (73·64)	929 (90·11)	1174 (95·45)	2986 (86·31)	
Private	225 (18·77)	90 (8·73)	36 (2·93)	351 (10·14)	
Others/Unknown	91 (7·59)	12 (1·16)	20 (1·62)	123 (3·55)	
Family history of cancer					0·28

(conclusão)

Variable	Before regulation (Jan/12 a Jul/13)	After municipal regulation (Jan/14 a May/15)	After state regulation (Jan/16 a Dec/17)	Total	
	n (%)	n (%)	n (%)	n (%)	p-value
No	540 (45·04)	434 (42·10)	527 (42·85)	1501 (43·38)	
Yes	491 (40·95)	419 (40·64)	508 (41·30)	1418 (40·98)	
Unknown	168 (14·01)	178 (17·26)	195 (15·85)	541 (15·64)	
Previous diagnosis/ treatment					0·07
With diagnosis	956 (79·74)	808 (78·37)	969 (78·78)	2733 (78·99)	
No diagnosis and treatment	136 (11·34)	132 (12·80)	79 (6·42)	437 (12·63)	
	101 (8·42)	87 (8·44)	1169 (13·74)	267 (7·72)	
Unknown	6 (0·50)	4 (0·39)	13 (1·06)	23 (0·66)	
Basis for diagnosis					<0·01
Histology of the primary tumor	1147 (95·66)	990 (96·02)	1143 (92·93)	3280 (94·80)	
Others/Unknown	52 (4·34)	41 (3·98)	87 (7·07)	180 (5·20)	
Detailed primary location					0·67
Exocervix	878 (73·23)	774 (75·08)	920 (74·80)	2572 (74·34)	
Cervix	309 (25·77)	248 (24·05)	294 (23·90)	851 (24·60)	
Endocervix	9 (0·75)	6 (0·58)	14 (1·14)	29 (0·84)	
Overlapping lesion of the cervix	3 (0·25)	3 (029)	2 (0·16)	8 (0·22)	
Clinical stage group (TNM)					0·78
1	209 (17·43)	196 (19·01)	199 (16·18)	604 (17·46)	
2	290 (24·19)	231 (22·41)	292 (23·74)	813 (23·50)	
3	329 (27·44)	257 (24·93)	294 (23·90)	880 (25·43)	
4	68 (5·67)	57 (5·53)	65 (5·28)	190 (5·49)	
Unknown	303 (25·27)	290 (28·12)	380 (30·90)	973 (28·12)	
Reason for not treating					< 0·01
Clinical conditions· advanced disease	94 (57·67)	9 (50·28)	105 (55·26)	288 (54·34)	
Treatment performed elsewhere	16 (9·82)	41 (23·16)	40 (21·05)	97 (18·30)	
Death	21 (12·88)	9 (5·08)	13 (6·84)	43(8·11)	
Abandonment of treatment	7 (4·29)	4 (2·26)	4 (2·11)	15 (2·83)	
Others/Unknown	25 (15·34)	34 (19·22)	28 (14·74)	87 (16·42)	
First hospital treatment received					< 0·01
Radiotherapy/ Chemotherapy	735 (61·30)	559 (54·22)	698 (56·75)	1992 (57·57)	
Surgery	339 (28·27)	344 (33·37)	399 (32·44)	1082 (31·27)	
Surgery/Radiotherapy/ Chemotherapy	37 (3·09)	33 (3·20)	45 (3·66)	115 (3·32)	
Others/None/No information	88 (7·34)	95 (9·21)	88 (7·15)	271 (7·84)	
Outcome after first treatment					< 0·01
Positive	771 (64·30)	671 (65·08)	872 (70·89)	2314 (66·88)	
Negative	309 (25·77)	279 (27·06)	289 (23·50)	877 (25·35)	
Unknown	119 (9·93)	81 (7·86)	69 (5·61)	269 (7·77)	
Hospital treatment facility					0·47

Variable	Before regulation (Jan/12 a Jul/13)	After municipal regulation (Jan/14 a May/15)	After state regulation (Jan/16 a Dec/17)	Total	
	n (%)	n (%)	n (%)	n (%)	p-value
INCA	877 (73·14)	776 (75·27)	920 (74·80)	2573 (74·36)	
Other institutions	322 (26·86)	255 (24·73	310 (25·20)	887 (25·64)	

Source: elaborated by the authors based on data from the HBCR (INCA, [2023]).

The implementation of municipal and state regulation led to a decrease in the median age indicator level of 4.99 and 5.65 (Table 2), respectively, representing an overall relative change of 1.88%. The number of people coming to the *Região Metropolitana I*, after state regulation increased by 17.17% (Table 2, figure 1A, and 1B).

At the beginning of the analyzed period, the percentage of people referred by the public health system was 77.29%, with a tendency to increase by 0.22% each month, reaching 81.47% in July 2013. Following municipal level regulation, there was an increase of 17.46%, with a decreasing trend of -1.13 each month. Subsequently, with the implementation of state regulation, there was a level increase of 19.71%, with a tendency to increase by 0.95% each month. The overall change for the period was 3.11% (Table 2, figure 1C)

A baseline level of 82% of patients met the regulatory criteria, that is, they came to specialized care with a confirmed diagnosis to start treatment. With the implementation of the municipal intervention a non-significant decrease was observed, followed by a statistically significant increase of 0.89% after state regulation (Table 2, figure 1D).

The percentage of patients in the stage I and II groups did not change significantly with the implementation of the analyzed interventions. When focusing on the percentage of patients who received surgical treatment as the first therapeutic option after municipal regulation, there was an increase of 14.88%, with an overall relative change of -19.05% (Table 2, Figure 2A, and 2B).

Turning to patients with a positive outcome after state regulation, there was an increase in level of 9.18%, with a monthly increase of 0.21% observed. As for the percentage of patients treated at INCA, a decrease of 19.38% was seen after the implementation of the state regulation, with a monthly increase of 1.32% and an overall relative change of 23.91% (Table 2, Figure 2C, and 2D).

Table 2 – Interrupted time series analysis for selected indicators considering patients with cervical cancer in the state of Rio de Janeiro. Baseline level and trend (Jan 2012-July 2013) by the Municipal regulation (August 2013) and State Regulation (June 2015) from January 2012 to December 2017

Indicators	Before regulation (January 2012 to July 2013)			After Municipal Regulation (August 2013 to May 2015)				After State Regulation (June 2015 to December 2017)			
	Baseline Level [Jan 2012]	Baseline Trend [Jan2012 to Jul2013]	Level prior to intervention I [Jul2013]	Level change [Jan2014] (IC 95%)	Trend [Jan2014 to May2015] (IC 95%)	% RC[1] [May 2015]	Level prior to intervention II [May 2015]	Level change [Jan2016] (IC 95%)	Trend [Jan2016 to Dec2017] (IC 95%)	% RC[1] [Dec 2017]	Level [December 2017]
MAP (years)	46·77	0·15	49·53	**-4·99 (-9·63 to -0·34)[1]**	-0·01 (-0·38 to 0·36)	1·65	47·54	**-5·65 (-10·74 to -0·55)[1]**	-0·08 (-0·41 to 0·26)	-5·66	44,13
CRM (%)	68·50	-0·48	59·42	**-0·48 (-1·21 to 0·25)[1]**	14·27 (0·24 to 28·3)	-7·59	63·30	**17·17[1] (2·48 to 31·86)**	0·23 (-0·77 to 1·24)	5·83	72,49
PHS (%)	77·29	0·22	81·47	**17·46 (6·97 to 27·95)[1]**	**-1·13 (-1·98 to -0·29)[1]**	9·33	84·50	**19·71 (8·85 to 30·58)[1]**	**0·95 (0·2 to 1·71)[1]**	30·14	100,59
MRC (%)	82·00	-0·10	80·05	4·55 (-6·8 to 15·9)	-0·48 (-1·39 to 0·44)	-9·44	74·26	5·86 (-6·03 to 17·75)	**0·89 (0·08 to 1·71)[1]**	2·50	84,05
PES (%)	55·12	0·04	55·88	-1·72 (-13·66 to 10·22)	0·29 (-0·68 to 1·26)	5·83	60·03	-4·06 (-17·05 to 8·92)	-0·39 (-1·24 to 0·47)	1·88	56,16
SFT (%)	36·58	-0·50	27·17	**14·88 (2·7 to 27·06)**	0·2 (-0·79 to 1·19)	65·07	34·59	10·77 (-2·45 to 23·99)	-0·29 (-1·17 to 0·59)	-19·05	29,61
PPO (%)	73·08	-0·15	70·27	3·95 (-6·68 to 14·57)	-0·13 (-0·99 to 0·74)	2·57	68·84	9·18 (-2·32 to 20·68)	0·21 (-0·56 to 0·97)	3·11	75,34
PTI (%)	76·27	-0·19	72·70	8·32 (-14·53 to 31·18)	0·2 (-1·64 to 2·04)	15·97	80·23	-19·38 (-42·82 to 4·05)	1·32 (-0·31 to 2·95)	23·91	94,50

Notes:

Bold: p value ≤ 0.05

[1]MAP: Median age; [2] CRM: People coming from the *Região Metropolitana I*; [3] PHS: People referred by the public health system, [4] MRC: Patients meeting regulatory criteria; [5] PES: Group I or II staging; [6]SFT: Patients who received surgery as their first treatment; [7] PPO: Patients with a positive outcome; [8] PTI: Patients treated at INCA.

Source: elaborated by the authors.

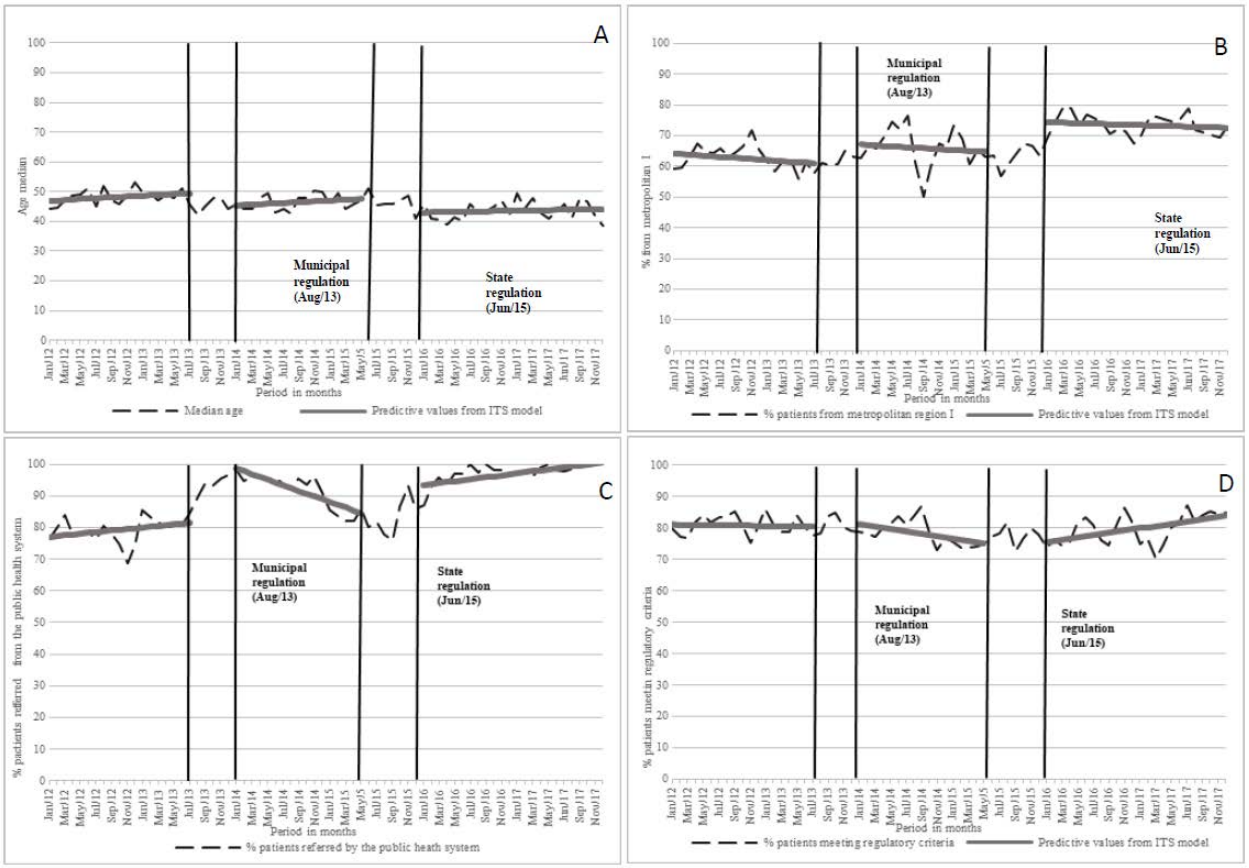

Figure 1 – Median age (A); percentage of people coming from the *Região Metropolitana I* (B); percentage of people referred by the public health system (C) and percentage of cervical cancer patients meeting regulatory criteria (D) for patients with cervical cancer in the state of Rio de Janeiro. Time period from January 2012 to December 2017, including baseline level and trend (Jan 2012-July 2013), the municipal regulation (August 2013) and state Regulation (June 2015)
Source: elaborated by the authors.

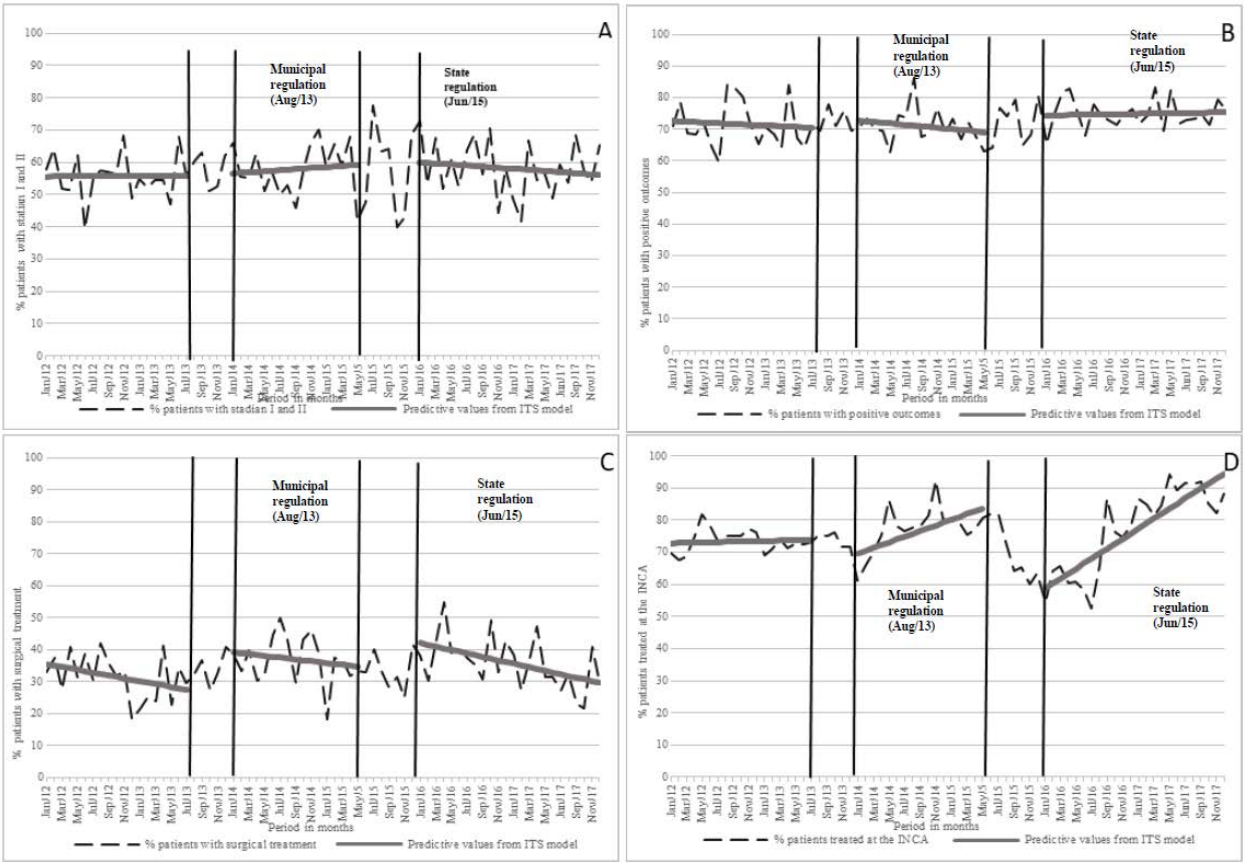

Figure 2 – Percentage of people with group I or II staging (A); percentage of people with a positive outcome (B) percentage of people who received surgery as their first treatment (C) and percentage of people treated at INCA (D) for patients with cervical cancer in the state of Rio de Janeiro
Time period from January 2012 to December 2017, including baseline level and trend (Jan 2012-July 2013), the municipal regulation (August 2013) and state Regulation (June 2015)
Source: elaborated by the authors.

The average distance that patients travelled was 44.92 km before regulation, 44.17 km with municipal regulation and 42.40 km after implementation of state regulation. The displacement maps show that with the interventions, there was a decrease in the number of places giving treatment (Figure 3). It is observed that for the last analyzed period there were no patients from *Região Centro-sul*. The *Região of Baía da Ilha Grande* treated 90% of its patients in the first period analyzed. After the interventions, all their patients were treated in the *Região Metropolitana I*.

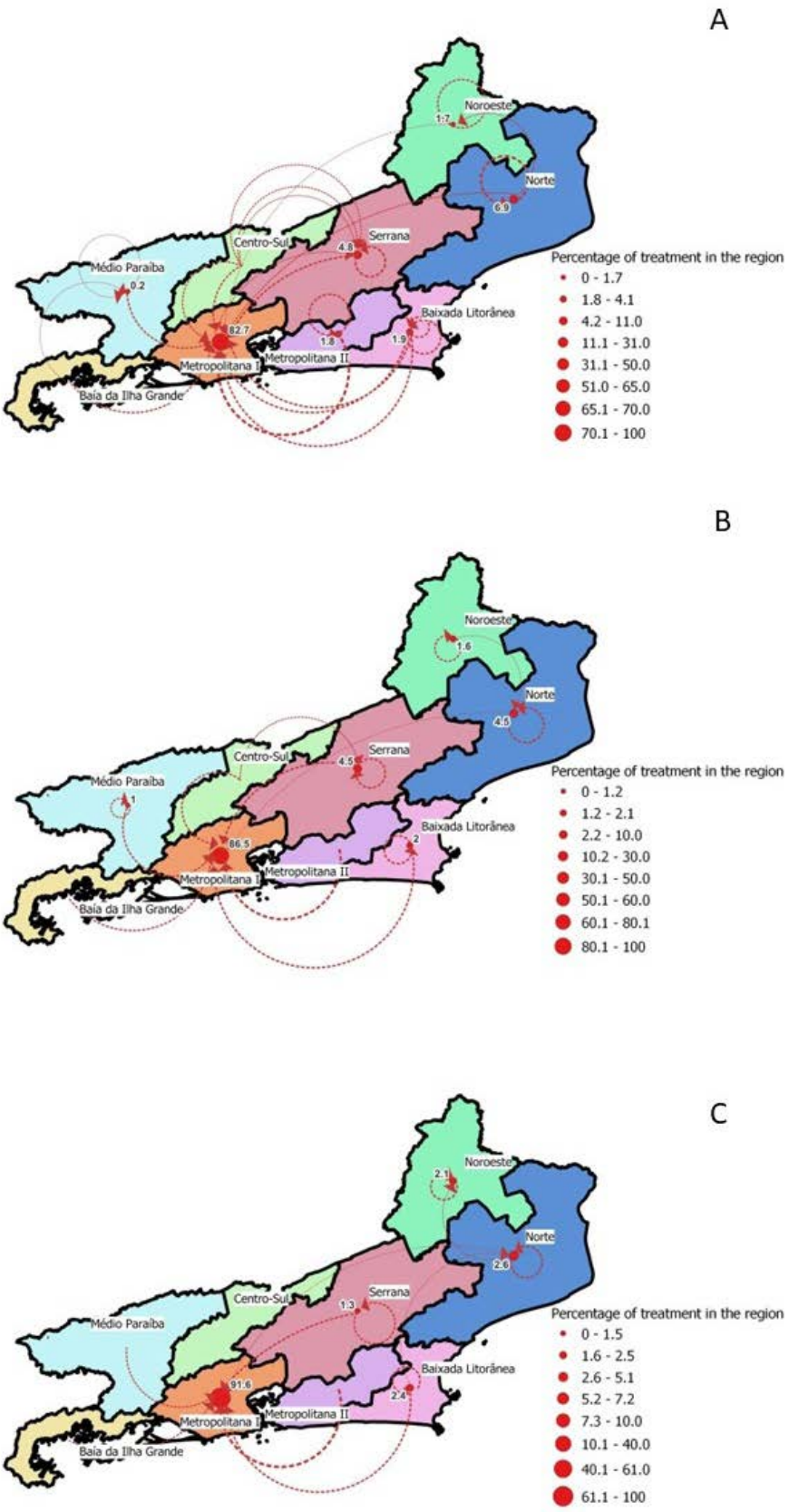

Figure 3 – Map of distribution patterns for cervical cancer treatment: (A) before the interventions.; (B) after municipal regulation (August 2013) and (C) after state regulation (June 2015) for patients with cervical cancer in the state of Rio de Janeiro
Source: elaborated by the authors.

DISCUSSION

The results suggest that regulation has been efficient in ensuring that patient referrals are only carried out by the public health system, since there was a significant increase in the level and trend for this indicator. However, when evaluating the displacement of patients to the treatment site, there is a greater concentration in Região Metropolitana I and the average distance traveled to the treatment site practically remained the same. Cancer treatment and diagnosis units are usually located in large centers, making geographical routes and access for the population difficult (Silva; O'Dwyer; Osorio-de-Castro, 2019).

Most women in this study declared themselves to be black ("*pardo*" or black) and had little schooling. It is known that these groups are more likely to be diagnosed in advanced stages, as there is greater difficulty in accessing health services, such as screening and diagnosis (Augusto, 2020, Paulista; Assunção; Lima, 2019, Renna Junior; Silva, 2018).

The diagnosis time is an important aspect of the clinical profile. When the regulatory framework is followed as recommended, the woman should have been diagnosed before reaching the tertiary level, so that she can be referred to specialized treatment according to her pathology (Carroll; Gomide, 2020). It was observed, however, that there is still a considerable number of patients who come to tertiary care without diagnostic confirmation. The occurrence of this type of situation could suggest that there is often a lack of structure in the other levels of care in the network which prevents diagnosis (Carvalho; O´Dwer; Rodrigues, 2018).

It was noted that some regions that had previously treated the population, such as Metropolitana II and the north, had their capacity reduced or even stopped treating patients. This finding suggests that regulation is increasing patients' need to move. Distance can represent another barrier to access to treatment and makes adherence difficult (Saldanha *et al.*, 2019).

The multiplicity of regulatory systems can lead to a greater fragmentation of care, suggesting the need for a better interface between them (Kniess, 2015; Pinto *et al.*, 2017). The regulations systems show only the available beds and do not specify that patient referral should be decided using software or through very well-established criteria. Thus, it is not possible to guarantee that it is being carried out in a way that would distribute patients equally, avoiding concentration in the *Região Metropolitana I*.

Even with the difficulties presented, there was no significant change in staging or clinical outcome in the periods analyzed. One hypothesis may be related to the expertise of multidisciplinary teams in the treatment of women with CC, since most patients were treated in specialized units (Silva; O'Dwyer; Osorio-de-Castro, 2019).

As a limitation of the work, we can mention the fact that the information is obtained from a database, which is subject to registration errors and a lack of information. In this study we found that the completeness of variables varied widely. We discovered that 0.66% of data was missing for previous diagnosis/treatment. whereas clinical stage had 28.12% missing and was imputed randomly. This method ignores relationships between variables because it only uses information from the missing variable itself, and it may introduce bias if the missing values are systematically different from the observed values. However, this limitation has a minimal impact on the study results since we did not use clinical stage to predict clinical outcomes, such as survival. We evaluated the percentage of patients in early clinical stages over time, therefore random imputation is an option since it preserves the distribution of the observed values in the imputed data and only imputes values that are observed in the dataset.

Despite the limitations presented, it is observed that the regulation implemented in isolation does not account for the multifactorial components of access to health services. However, the results presented here refute the hypothesis that regulation would have deleterious effects, or even negative externalities on staging at the time of entry into the system or on the favorable clinical outcome of the treated patient.

In addition to the analysis of clinical outcome information, it has been shown that there is a greater concentration in treatment sites, which can serve as a barrier to access. This shows that there are other issues that must be resolved for satisfactorily access to take place. It is necessary that managers from different levels of care come together to create consistent and resolute strategies so that treatment is carried out in a timely manner and women are able to have a better prognosis.

Thus, it is crucial to constantly evaluate and monitor indicators to support health management and redirect and adjust conduct, when necessary. In the specific case of the CCU, it is extremely urgent to increase the number of patients in tertiary care, which must be added to a set of actions to invest in infrastructure and systems integration, aiming for an improvement in the equity of access.

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