

Temporal trend of Mammography Coverage in the National Health System, Brazil, 2010-2019

Tendência Temporal da Cobertura de Mamografias no Sistema Único de Saúde, Brasil, 2010-2019

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Tendência Temporal da Cobertura de Mamografias no Sistema Único de Saúde, Brasil, 2010-2019

Tendencia Temporal de la Cobertura de Mamografías en el Sistema Único de Salud, Brasil, 2010-2019

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ABSTRACT

Introduction: Breast cancer in Brazil has high incidence and mortality rates despite the declining trend of mortality in some regions. **Objective:** To describe the trend of mammograms screening coverage in Brazilian macroregions and states and identify the influence of the national breast cancer control policies between 2010-2019. **Method:** The ratio of screening mammograms in the age group of 50-69 years per local of residence was calculated minus the population of health-insured residents in that age group and period. The trend was evaluated by the Joinpoint regression model. **Results:** Coverage raised in Brazil from 2010-2014 and declined from 2014-2019, with increase of the proportion of exams in the target population. This pattern was noticed in other regions, except the Midwest, but with different year of shifting trend. Two significant shifting points were identified in the country: from 2010-2014, with increasing trend (APC 8.7, 95%CI 6.2; 11.3), and from 2014-2019 with decreasing trend (APC -4.2, 95%CI -5.7; -2.7). The Northeast region was the only one with three points of shifting trend: from 2010-2012 (APC 30.3, 95%CI 22.9; 38.2), 2012-2017 (APC 4.7, 95%CI 3.0; 6.4) and 2017-2019 (APC -14.9, 95%CI -19.7; -9.8). No trend was identified for the Midwest region. **Conclusion:** There was an increase in the proportion of screening mammograms performed in the target population in the period for Brazil and macroregions, and a declining trend in mammograms coverage from 2014 onwards. These results indicate the priority given to the target population in the program of screening actions.

Key words: breast neoplasms; early detection of cancer; time series studies; health status indicators; health evaluation.

RESUMO

Introdução: O câncer de mama no Brasil apresenta elevadas taxas de incidência e mortalidade apesar da tendência de redução da mortalidade em algumas Regiões. **Objetivo:** Descrever a tendência da cobertura de mamografias de rastreamento nas Macrorregiões e Estados brasileiros e identificar a influência de Políticas Nacionais voltadas ao controle do câncer de mama entre 2010-2019. **Método:** Foi calculada a razão entre mamografias de rastreamento na faixa etária de 50-69 anos por local de residência e subtraída a população das residentes com plano de saúde na faixa etária e no período referidos. A tendência foi avaliada pelo modelo de regressão *Joinpoint*. **Resultados:** A cobertura aumentou no Brasil de 2010-2014 e apresentou queda de 2014-2019, com aumento na proporção de exames realizados na população-alvo. Esse padrão foi observado nas demais Regiões, exceto na Centro-Oeste, porém com ano de mudança da tendência diferente. Foram identificados dois pontos de mudança no país: de 2010-2014, com tendência crescente (APC 8,7, IC 95% 6,2; 11,3), e de 2014-2019, com tendência decrescente (APC -4,2, IC 95% -5,7; -2,7), ambos significantes. A Região Nordeste foi a única com três pontos de mudança de tendência: 2010-2012 (APC 30,3, IC 95% 22,9; 38,2), 2012-2017 (APC 4,7, IC 95% 3,0; 6,4) e 2017-2019 (APC -14,9, IC 95% -19,7; -9,8). Não foi identificada tendência para a Região Centro-Oeste. **Conclusão:** Houve crescimento na proporção de mamografias de rastreamento realizadas na população-alvo no período, para Brasil e Regiões, e tendência de redução na cobertura da mamografia a partir de 2014. Esses resultados indicam priorização da população-alvo do programa nas ações de rastreamento.

Palavras-chave: neoplasias da mama; detecção precoce de câncer; estudos de séries temporais; indicadores básicos de saúde; avaliação em saúde.

RESUMEN

Introducción: El cáncer de mama en Brasil tiene altas tasas de incidencia y mortalidad a pesar de tendencia a reducción de mortalidad en algunas regiones. **Objetivo:** Describir tendencia en cobertura de mamografías de cribado en Macrorregiones y Estados brasileños e identificar influencia de políticas nacionales de control del cáncer de mama entre 2010-2019. **Método:** Calculó la razón entre mamografías de detección en grupo de edad 50-69 años por residencia, menos la población de las residentes con seguro médico en ese grupo de edad y período. La tendencia se evaluó mediante modelo de regresión *Joinpoint*. **Resultados:** Cobertura aumentó en Brasil de 2010-2014 y disminuyó de 2014-2019, con aumento en proporción de pruebas realizadas en población objetivo. Este patrón se observó en otras regiones, excepto Medio Oeste, con diferente año de cambio de tendencia. Se identificaron dos puntos de cambio en país: 2010-2014, con tendencia creciente (APC 8,7, IC 95% 6,2; 11,3), y 2014-2019 con tendencia decreciente (APC -4,2, IC 95% -5,7; -2,7), ambos significativos. Región Nordeste fue única con tres puntos de cambio de tendencia: 2010-2012 (APC 30,3, IC 95% 22,9; 38,2), 2012-2017 (APC 4,7, IC 95% 3,0; 6,4) y 2017-2019 (APC -14,9, IC 95% -19,7; -9,8). No se identificó ninguna tendencia para Región Medio Oeste. **Conclusión:** Hubo un aumento en proporción de mamografías de detección realizadas en población en período, para Brasil y regiones, y una tendencia a reducción de cobertura mamográfica a partir de 2014. Estos resultados indican priorización de población del programa en acciones de cribado.

Palabras clave: neoplasias de la mama; detección precoz del cáncer; estudios de series temporales; indicadores de salud; evaluación en salud.

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INTRODUCTION

The highest incidence rates of breast cancer are found in developed countries but at the same time, the mortality rates in these countries are low against low-and-middle income countries¹. The wide variation of this type of cancer in distinct countries reflects differentiated patterns of risk and access to early detection and timely treatment².

In Brazil, 66,280 new cases of breast cancer were estimated for 2021, accounting for 29.7% of all cancers in women, except non-melanoma skin cancer³. In 2019, the mortality rate adjusted by the world population in the country was 14.23 per 100 thousand women, ranging from 10.83 in the North Regions to 15.08 in the South Region⁴. A recent study investigating the mortality in the last four decades shows trend of decreasing mortality in the South and North Regions⁵.

In 2004, the recommendations for breast cancer control were determined in Brazil with the indication of the target-population for screening and periodicity of mammograms⁶. In 2006, control actions were boosted with tripartite-agreement of indicators of follow-up of this cancer⁷ and in 2007, specific procedures were created by the National Health System (SUS) to monitor breast cancer screening exams⁸. The Breast Cancer Control Information System (Sismama)⁹ entered into force in 2009 through Directive 779, simultaneous with a specific screening mammogram procedure to monitor the offer¹⁰. In parallel, actions of financial stimulus to induce screening mammograms were put in place¹¹.

The objective of this article is to describe the evolution of screening mammograms in Brazilian Macroregions and States and discuss the results of breast cancer control national policies between 2010 and 2019.

METHOD

Study about the trend of coverage of screening mammograms in Brazil, Regions, States and Federal District with data from SUS from 2010 to 2019.

Public access data were utilized: population residing in the municipality, age, sex from the forecasts of “*Instituto Brasileiro de Geografia e Estatística (IBGE)*”, number of screening mammograms reported at the Outpatient Health Information System (SIA/SUS)¹², and private health insured-population according to the National Health Agency (ANS)¹³.

The coverage of mammograms and proportion of screening mammograms performed for the target age-range were estimated.

The ratio between the number of screening mammograms (code 02.04.03.018-8) done by half of

the women in the age-range of 50-69 years per local of residence minus the population of residing private-insured women in the same age-range in Brazil from 2010 to 2019 was calculated. Half of the target-population was the base for the coverage estimates of 100% of the target-population in two years.

The descriptive analysis of the time series of the indicators of screening mammograms was made through graphs for the period 2010-2019 with the software R (version 4.1.2)¹⁴ for Brazil and Regions.

The changes of the pattern of trend encountered were evaluated with the Joinpoint regression model¹⁵ for each unit of analysis which investigates time trends and identifies statistically significant shifting trends and annual percent change – APC. Constant variance and log of coverage were defined as parameters. Joinpoint utilizes Monte-Carlo permutation tests and the level of significance is given by the Bonferroni correction, which considers the non-constant variance of the Poisson model and errors of autocorrelation¹⁶.

The Institutional Review Board approval was waived because only secondary data were utilized with unidentified individuals in compliance with the National Health Council (CNS) Ordinance 466, December 12, 2012¹⁷.

RESULTS

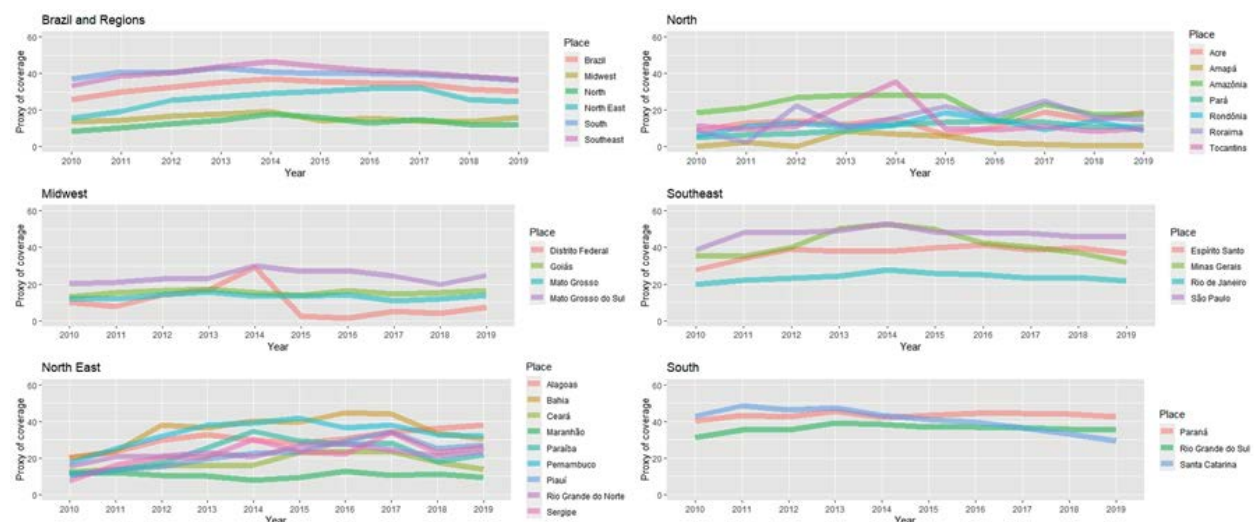
From 2010 to 2019, 22,962,559 screening mammograms were registered in the age-range of 50 to 69 years. Of these, 50.79% in the Southeast, 22.78% in the Northeast, 20.39% in the South, 3.42% in the Midwest and 2.63% in the North regions.

The proportion of screening mammograms in 50-69 years old women, considering the total of exams, increased progressively between 2010 and 2019 in Brazil, moving from 51.0% in 2010 to 65.4% in all regions. The North Region presented the lowest proportion in 2010 (47.5%) and the highest in 2019 (65.7%) according to Table 1.

The coverage of screening mammograms increased from 2010 to 2014 in the country and continuous drop from 2014 to 2019. This trend was found for all the regions except the Midwest but with different shifting trend year; in the North Region, the increase of coverage occurred until 2015; in the Northeast, the trend of increase happens until 2017 and decreasing trend, in the end of the series in 2018. In the Southeast region a rising trend until 2014 was noticed while in the South Regions, the increase occurs until 2013 when the series began. In the Midwest, the trend of growth was detected until 2014 with drop from 2015 onwards, but with peaks of growth in 2016 and 2019, always lower than the ratio of 2014 according to Graph 1.

Table 1. Annual distribution (%) of screening mammograms in 50-69 years old women, Brazil and geographic regions

Local	Year									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Brazil	51.0	52.0	52.9	54.4	58.2	60.5	62.2	64.5	64.0	65.4
North	48.3	48.3	48.0	49.9	51.7	53.6	55.5	56.8	56.1	57.1
Northeast	47.5	48.7	52.0	54.0	59.9	61.8	64.0	68.2	64.7	65.7
Southeast	52.1	53.1	53.5	54.9	58.0	60.6	62.3	64.2	64.5	65.4
South	51.9	52.8	53.1	54.7	59.4	61.0	61.8	63.0	64.1	64.7
Midwest	48.6	50.2	51.0	51.7	52.3	53.0	54.9	57.0	59.5	60.0

**Graph 1.** Proxy of coverage of mammograms in 50-69 years old women between 2010 and 2019 per Federation Unit, Region and Brazil

With the Joinpoint regression analysis for Brazil¹⁵, two shifting points were detected: from 2010 to 2014 with increasing trend (APC 8.7, CI 95% 6.2; 11.3) and from 2014 to 2019 with decreasing trend (APC -4.2, CI 95% -5.7; -2.7), both significant.

The Northeast Region was the only with three shifting trends points: from 2010 to 2012 with higher APC among the regions (APC 30.3, CI 95% 22.9; 38.2), 2012 to 2017 (APC 4.7, CI 95% 3.0; 6.4) and 2017 to 2019 (APC -14.9, CI 95% -19.7; -9.8). No trend was identified for the Midwest Region.

North, Southeast and South Regions had two shifting trend points. But for North and Northeast, the first point was from 2010 to 2014 (APC 18.7, CI 95% 14.0; 23.7 and APC 7.6, CI 95% 5.6; 9.6), and the second, from 2014 to 2019 (APC -7.8, CI 95% -10.3; 5.2 and APC -4.7, CI 95% -6.0; -3.5), respectively. For the South Region, the first point was from 2010 to 2013 (APC 3.7, CI 95% -0.3; 7.8) and the second from 2013 to 2019 (APC -2.2, CI 95% -3.3; -1.2). Only the North and Southeast regions had significant variation in the two periods, as shown in Table 2.

DISCUSSION

The proportion of screening mammograms of 50-69 years old women increased between 2010 and 2019 in Brazil and Regions, indicating that the target-population was prioritized at SUS along the years. It is a positive outcome based in the evidences and recommendations¹⁸. The coverage of mammograms (number of exams/population) in this age-range, however, presented declining trend since 2014 with annual decrease of 4.2% until 2019.

In 2010, screening mammograms was funded by “*Fundo de Ações Estratégicas (FAEC)*” for asymptomatic women from 35 years old. In 2014, it was determined that the asymptomatic female population of 50-69 years was a priority to do this exam at every two years as a result of a change of the scope of the exam¹¹. It is possible that after the change, the target-population has been prioritized even if the offer has declined.

For Brazil and the North, Southeast and South Regions two patterns of trend were detected: growth in the first period and decrease in the second, the year 2014

Table2. Joinpoint regression trend analysis of coverage of screening mammograms in 50-69 years old women between 2010 and 2019 per Federation Unit in each Brazilian region

Region	FU	Trend 1			Trend 2			Trend 3		
		Years	APC	CI 95%	Years	APC	CI 95%	Years	APC	CI 95%
Brazil		2010 to 2014	8.7	6.2; 11.3	2014 to 2019	-4.2	-5.7; -2.7	-	-	-
North		2010 to 2014	18.7	14.0; 23.7	2014 to 2019	-7.8	-10.3; -5.2	-	-	-
	Acre	2010 to 2019	4.1	-2.5; 11.2	-	-	-	-	-	-
	Amapá	2010 to 2014	150.6	37.5; 356.6	2014 to 2019	-46.6	-64.0; -20.8	-	-	-
	Amazonas	2010 to 2019	-3.3	-8.0; 1.6	-	-	-	-	-	-
	Pará	2010 to 2015	23.2	19.0; 27.5	2015 to 2019	-7.1	-11.7; -2.2	-	-	-
	Rondônia	2010 to 2019	2.9	-3.9; 10.1	-	-	-	-	-	-
	Roraima	2010 to 2019	16.1	5.1; 28.2	-	-	-	-	-	-
	Tocantins	2010 to 2019	-3.9	-14.3; 7.9	-	-	-	-	-	-
Northeast		2010 to 2012	30.3	22.9; 38.2	2012 to 2017	4.7	3.0; 6.4	2017 a 2019	-14.9	-19.7; -9.8
	Alagoas	2010 to 2012	24.6	8.0; 43.7	2012 to 2015	-1.8	-14.8; 13.2	2015 a 2019	7.2	2.9; 11.6
	Bahia	2010 to 2012	39.4	10.9; 75.2	2012 to 2017	4.2	0.2; 8.4	2017 a 2019	-19.6	-36.0; 1.1
	Ceará	2010 to 2017	10.1	6.1; 14.2	2017 to 2019	-25.9	-51.0; 12.0	-	-	-
	Maranhão	2010 to 2019	-0.5	-3.6; 2.7	-	-	-	-	-	-
	Paraíba	2010 to 2014	23.2	19.0; 27.5	2014 to 2019	-7.1	-11.7; -2.2	-	-	-
	Pernambuco	2010 to 2012	38.5	-0.9; 93.7	2012 to 2015	7.0	-18.6; 40.6	2015 a 2019	-6.8	-12.3; -1.0
	Piauí	2010 to 2017	16.2	13.9; 18.6	2017 to 2019	-15.2	-37.1; 14.4	-	-	-
	Rio Grande do Norte	2010 to 2016	7.2	2.6; 12.0	2016 to 2019	-7.5	-20.9; 8.1	-	-	-
Sergipe	2010 to 2012	63.1	-22.6; 243.5	2012 to 2019	2.5	-2.9; 8.2	-	-	-	
Southeast		2010 to 2014	7.6	5.6; 9.6	2014 to 2019	-4.7	-6.0; -3.5	-	-	-
	Espírito Santo	2010 to 2012	18.2	-0.6; 40.6	2012 to 2019	-0.1	-1.9; 1.8	-	-	-
	Minas Gerais	2010 to 2014	12.9	6.8; 19.4	2014 to 2019	-9.5	-12.8; -6.0	-	-	-
	Rio de Janeiro	2010 to 2014	7.7	6.1; 9.3	2014 to 2019	-4.0	-5.0; -3.1	-	-	-
	São Paulo	2010 to 2013	7.3	1.5; 13.4	2013 to 2019	-2.1	-3.6; -0.6	-	-	-
South		2010 to 2013	3.7	-0.3; 7.8	2013 to 2019	-2.2	-3.3; -1.2	-	-	-
	Paraná	2010 to 2019	0.4	-0.2; 1.0	-	-	-	-	-	-
	Rio Grande do Sul	2010 to 2013	6.1	3.6; 8.8	2013 to 2019	-1.4	-2.0; -0.8	-	-	-
	Santa Catarina	2010 to 2012	4.4	-11.9; 23.8	2012 to 2017	-5.3	-7.7; -2.9	2017 a 2019	-10.7	-24.7; 5.9
Midwest		2010 to 2013	12.0	-15.2; 48.1	2013 to 2017	-7.6	-29.6; 21.3	2017 a 2019	6.0	-46.0; 107.8
	Federal District	2010 to 2019	-15.0	-30.3; 3.7	-	-	-	-	-	-
	Goiás	2010 to 2012	13.6	-31.2; 87.6	2012 to 2015	-5.1	-37.8; 44.8	2015 a 2019	2.5	-6.7; 12.7
	Mato Grosso	2010 to 2013	8.2	-10.0; 30.1	2013 to 2019	-3.8	-8.8; 1.6	-	-	-
	Mato Grosso do Sul	2010 to 2015	7.5	0.5; 15.0	2015 to 2019	-7.0	-15.8; 2.7	-	-	-

Captions: APC = annual percent change); FU = Federation Unit; CI = confidence interval.

was identified as the shifting year for Brazil, North and Southeast Regions. For the South Region, the shifting year was 2013. The Northeast region had three patterns of trend with increase in the first year and in the second period until 2017 with declining trend only in the last two years of the period. The differentiated shifting trend point

suggests an effect that had first manifested in the South Region and later in the other Regions. The Northeast Region had three patterns of trend and with greatest increase of exams for the target-population compared with the other Regions. It was detected a slowdown in the second period, and only between 2017 and 2019,

the coverage of mammograms dropped similar to what occurred previously in the other Regions.

Worldwide, the trend of the coverage of screening mammogram has varied substantially. Dehkordy et al.¹⁹ evaluated the screening mammogram coverage between 2007 and 2012 in USA and found a declining trend among women in every age-range. Other authors found decrease of the number of women seeking screening²⁰⁻²², potentially justifying a stability or even reduction of the incidence rates²³. Several issues might be related with the recent drop detected in some developed countries, hypothesizing that screening alone does not cause a palpable impact on mortality drop²⁴. In middle-and-low-income countries, the scarce offer of exams and low-quality diagnostic results can explain better this decline.

The study findings pointing to a declining trend in the last years of coverage of screening mammograms in Brazil need to be best understood and some of the conditions described ahead may bear some kind of connection with this affirmative. During the study period, two information systems for breast cancer control were implemented and for the first time, it was possible to count with epidemiological data of mammograms at SUS: Sismama⁹, and Cancer Information System (Siscan), developed to replace Sismama and undergoing implementation since 2013 through Ordinance number 3,394²⁵, with different levels of implementation across the country²⁶. Both Sismama and Siscan generate the payable file of the exams performed that must be handed over by the service contractor to the Outpatient Health Information System (SIA)^{9,25}.

The system change led to the loss of epidemiological information because the national consolidation of Sismama registers was interrupted and the information from Siscan do not reflect 100% of the exams performed at SUS. Nevertheless, the information about the billed exams continued to be fed to SIA, regardless of the information system utilized²⁶. For that reason, the current analysis decided to utilize the information from SIA due to larger coverage. Yet, it is possible that the system change may have somehow impacted the exams performed and reported to SIA/SUS.

The National Program of Improvement of Access and Quality of Basic Attention (PMAQ)²⁷, created in 2011 with specific budget has the objective of expanding the access and improve the quality of basic attention. Strategic indicators were agreed, however, notwithstanding the perspective of holding connection with the indicators of Pact for Health⁷, it failed to include indicators of mammograms. The lack of monitoring of a specific marker for breast cancer may have impacted the control actions of this neoplasm even with the endorsement of the National Policy for Prevention and Control of Cancer (PNCC),

through Ordinance number 874²⁸ of the Ministry of Health for actions of early detection, monitoring and quality control of screening exams.

In 2015, the Guidelines for Early Detection of Breast Cancer in Brazil²⁹ reiterated the age-range of 50-69 years of age for women as target-population for screening every two years and strategies of prioritizing of symptomatic cases to reduce diagnostic delay. Although the implementation of guidelines may have caused a stricter selection of symptomatic cases at the expense of asymptomatic, there are no studies to support this hypothesis.

Regardless of some inducive policies and incentives for municipalities, the breast cancer screening has ever been implemented in Brazil. The implementation of organized screening programs in a country with great social and economic inequities demands complex procedures further to still unequal and socially unjust public health infrastructure in the Regions³⁰.

Recently, the debates about risks and benefits of mammogram screening is gaining space in the literature and the questioning about its impact on mortality is less than expected³¹. Emphasis on very early detection has been prioritized in high-income countries which have already tried screening with quite acceptable coverage since the 1990's²⁰. In Brazil, despite the 2015 Ordinances²⁹ have drawn attention to this issue, the practice still hinges on opportunistic screening. As shown herein, coverages still fall short from the required level. Several are the questions for ineffective screening, among them, the unstandardized practice in all the States that a licensed nurse practitioner could request a mammogram³², difficulty many women find in submitting to timely mammogram³³ and after the result, be referred for diagnostic of suspicious cases³⁴.

At last, early diagnosis of symptomatic women is a more suitable strategy for the Brazilian scenario as most of the cases is diagnosed later³⁵. This strategy is contingent upon the capacity health networks should develop to train their professionals and implement agile mechanisms for early diagnosis.

CONCLUSION

Since 2014, coverage of screening mammograms for 50-69 years old women declined but the proportion for this same group increased. The results suggest that, despite poor coverage and declining trend, the population selected for screening is being examined.

CONTRIBUTIONS

Luciana Leite de Mattos Alcantara contributed to the study design, acquisition, analysis and interpretation of

the data, wording and critical review. Jeane Tomazelli, Fernanda Rodrigues Gonçalves Zeferino, Beatriz Fátima Alves de Oliveira and Gulnar Azevedo e Silva participated of the wording and critical review. All the authors approved the final version published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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None.

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