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REVIEW

NURSE'S KNOWLEDGE ABOUT GENETICS AND GENOMICS APPLIED TO BREAST CANCER

CONHECIMENTO DE ENFERMEIROS SOBRE GENÉTICA E GENÔMICA APLICADO AO CÂNCER DE MAMA

CONOCIMIENTO DE ENFERMEROS SOBRE GENÉTICA Y GENOMAS APLICADOS AL CÁNCER DE MAMA

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ABSTRACT

Objective: to identify nurse's knowledge in genetics and genomics applied to breast cancer. **Method:** a cross-sectional study with the application of a questionnaire developed by the authors to clinical nurses, over 18 years old, working in secondary and tertiary care, in the city of Belém do Pará, the northern region of Brazil. Convenience sampling technique was performed in the collection places and simple random sampling for a minimum sample number of 71 participants. **Results:** Eighty nurses with an average age of 42 years old were approached, most of the experts. There were differences between the level of care in which nurses work and the first contact with genetics and/or genomics ($p<0.001$); between the concept of DNA ($p<0.0001$); knowledge about the genogram ($p=0.004$); knowledge about the age group of mammographic screening with familial risk ($p=0.027$); the clinical examination performed by a trained physician or nurse, annually, from 40 years old ($p=0.005$). Most cases of breast cancer occur due to hereditary genetic changes ($p=0.0004$) and early menarche, late menopause, nulliparity, hormonal changes, sedentary lifestyle, overweight, smoking, and hormonal therapy, which are the main risks factors for sporadic breast cancer ($p=0.0039$). **Conclusion:** a knowledge gap about the concepts of genetics and genomics applied to breast cancer was identified between the two groups.

Keywords: Genetics; Genomics; Breast Neoplasms; Nurses; Secondary Care; Tertiary Healthcare

RESUMO

Objetivo: *identificar o conhecimento de enfermeiros em genética e genômica aplicado ao câncer de mama.* **Método:** *estudo transversal com a aplicação de um questionário desenvolvido pelos autores a enfermeiros assistenciais, maiores de 18 anos, atuantes na atenção secundária e terciária, no município de Belém do Pará, região Norte do Brasil. Realizada técnica de amostragem por conveniência em relação aos locais de coleta e amostragem aleatória simples para o número amostral mínimo de 71 participantes.* **Resultados:** *foram abordados 80 enfermeiros com idade média de 42 anos, sendo a maior parte de especialistas. Verificaram-se diferenças entre o nível da atenção em que os enfermeiros atuam e o primeiro contato com genética e/ou genômica ($p<0,001$); entre o conceito de DNA ($p<0,0001$); o conhecimento sobre o heredograma ($p=0,004$); conhecimento sobre a faixa etária do rastreamento mamográfico com risco familiar ($p=0,027$); o exame clínico realizado por um médico ou enfermeira treinados, anualmente, a partir de 40 anos ($p=0,005$). A maioria dos casos de CA de mama ocorre devido a alterações genéticas hereditárias ($p=0,0004$) e da menarca precoce, menopausa tardia, nuliparidade, alterações hormonais, sedentarismo, sobrepeso, tabagismo e terapia hormonal, que são os principais fatores de risco para o câncer de mama esporádico ($p=0,0039$).* **Conclusão:** *identificou-se uma lacuna de conhecimento sobre os conceitos de genética e genômica aplicados ao câncer de mama entre os dois grupos.*

Palavras-chave: *Genética; Genômica; Neoplasias da Mama; Enfermeiras e Enfermeiros; Atenção Secundária à Saúde; Atenção Terciária à Saúde.*

RESUMEN

Objetivo: *identificar los conocimientos de enfermeros en genética y genómica aplicadas al cáncer de mama.* ***Método:*** *estudio transversal con la aplicación de un cuestionario desarrollado por los autores a enfermeros asistenciales, mayores de 18 años, que trabajan en la atención secundaria y terciaria, en la ciudad de Belém do Pará, región norte de Brasil. Se realizó una técnica de muestreo por conveniencia con relación a los sitios de recolección y muestreo aleatorio simple para una muestra mínima de 71 participantes.* ***Resultados:*** *se abordó a 80 enfermeros con una edad promedio de 42 años, la mayoría especialistas. Hubo diferencias entre el nivel de atención en el que trabajan los enfermeros y el primer contacto con la genética y / o genómica ($p <0,001$); entre el concepto de ADN ($p <0,0001$); conocimiento sobre el árbol genealógica ($p = 0,004$); conocimiento sobre el grupo de edad de cribado mamográfico con riesgo familiar ($p = 0,027$); el examen clínico realizado por un médico o enfermero capacitado, anualmente, a partir de los 40 años ($p = 0,005$). La mayoría de los casos de CA de mama se producen por alteraciones genéticas hereditarias ($p = 0,0004$) y menarquia precoz, menopausia tardía, mujeres que nunca han parido, cambios hormonales, sedentarismo, sobrepeso, tabaquismo y terapia hormonal, que son los principales factores de riesgo de cáncer de mama esporádico ($p = 0,0039$).* ***Conclusión:*** *entre los dos grupos se identificó una brecha de conocimiento sobre los conceptos de genética y genómica aplicados al cáncer de mama.*

Palabras clave: *Genética; Genómica; Neoplasias de la Mama; Enfermeras y Enfermeros; Atención Secundaria de Salud; Atención Terciaria de Salud.*

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INTRODUCTION

The global burden of female breast cancer (BC), measured by the incidence or mortality, is growing and substantial in several countries. In 2017, the incidence was 2 million new cases and 601 thousand deaths in women worldwide.[1] In Brazil, the estimated risk is 61.61 new cases per 100 thousand women for the triennium 2020-2022, taking the first position among the most frequent malignant neoplasms in all regions, and presenting a risk of death of 16.16 per 110 thousand.[2] The state of Pará has the same increasing trend in cases over the last five years.[3]

The National Oncology Care Policy (*Política Nacional de Atenção Oncológica - PNAO*) seeks to ensure comprehensive care at the three levels of care. Primary health care (PHC) is the first level of care and coordinates care at all levels. Diagnostic investigation and treatment are performed in specialized secondary and tertiary care services, respectively. The tertiary care service offers a high-complexity and high-cost therapy such as radiotherapy, chemotherapy, and cancer surgeries.[4]

BC is a chronic, non-communicable, genetic disease - which can manifest in hereditary syndromes (5 to 10% of cases, associated with inherited genetic mutations) - or sporadic (90% of cases, associated with somatic mutations acquired throughout life).[5] Therefore, nurses are expected should apply basic concepts of genetics and genomics in practice, especially in cancer care, whose skills and competencies permeate management, teaching, research, professional development, and care (from theoretical concepts to diagnosis and treatment).[6]

In Brazil, the nurses are the professionals in greatest contact with the female population in the health care network and the driving force in the applicability of current health policies.[7] They work in prevention, screening, and treatment to reduce morbidity and mortality by BC. This professional is an essential component of the multidisciplinary team with various skills at all levels of health care, including in carrying out genetic counseling, as long as they are qualified.[8-10]

However, there is a certain delay in the training of Brazilian nurses on the applicability of the concepts of genetics and genomics to cancer in the world, whose disparities are even more significant between Brazilian regions.[11] We found only two national studies that showed limited knowledge about genetics and genomics among nurses working in primary[12] and tertiary[13] care.

Thus, this research is relevant due to: a) the increase in the number of cases of the disease and its morbidity and mortality; b) the need for knowledge about genetics and genomics of nurses who provide care to patients with BC; c) the lack of studies on the topic in the North of Brazil that compare the knowledge of nurses at different levels of care. It is believed that nurses do not know about genetics and genomics applied to the BC, regardless of the level of health care in which they work. Thus, this study aimed to identify nurse's knowledge in genetics and genomics applied to BC.

METHOD

This is a cross-sectional study guided by the tool called Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[14] applied to nurses involved in the care of cancer patients.

We used the non-probabilistic convenience sampling technique since we selected the only two medium-complexity units directed to breast cancer (one state and one municipal) and one of high complexity (*Unidade de Alta Complexidade em Oncologia* - UNACON) in the municipality of *Belém do Pará*, Northern region of Brazil.

To have parity between the health units (secondary care), we adopted the simple random sampling technique, with an expected frequency of 90% and a margin of error of 5%. Thus, the sample number considered as the minimum limit for the collection was 71 participants.

The study included clinical nurses over 18 years old, who worked in secondary and tertiary care for women with BC, and who voluntarily agreed to participate and signed the Informed Consent Form (ICF). We exclude children under 18 years old, non-assistance professionals, from another category, or nurses who were on vacation, leave, or retired.

We invited 118 nurses for this study but 16.22% of cases refused to participate and only one returned the questionnaire without a response, resulting in a population of 80 nurses approached between August and October 2018.

For data collection, the authors designed a questionnaire due to the lack of an instrument on the variables of interest in this study. The questionnaire was created following international competences on genetics and genomics[15], current national health policies[7-9], and class council resolutions.[10] This self-administered questionnaire with three domains was intended for sociodemographic variables, knowledge about genetics/genomics, and breast cancer.

Initially, the questionnaire was submitted to the content validation strategy using the more simplified Delphi technique, without statistical inference, following the steps: selection of participants, preparation of questionnaires, participation and content validation by experts or specialists, and analysis of the questionnaires until obtaining the level of consensus.[16] The content validation process took place in July 2018, when the invitation letter, the assessment instrument, and the questionnaire produced were sent by e-mail. Each item in the questionnaire was evaluated for presentation, clarity, length of announcements, and response time, and judged as agree, disagree, and suggestions.

Ten nurses over 18 years old and working directly or indirectly in Oncology participated in the validation. They could be professors, researchers, or residents of the Multi-professional Residency Program at the *Hospital Universitário João de Barros Barreto of the Universidade Federal do Pará*. All suggestions were accepted and, then, a pilot test was carried out with 10 resident nurses from Oncology from the same program. Such data were not included in the results of this study but they ensured the improvement and elimination of confounders present in the questionnaire.

The definitive version of the questionnaire had 19 questions referring to three domains (sociodemographic characterization, basic concepts of genetics/genomics, and breast cancer). The questions were dichotomous (true or false/yes or no) or multiple choice.

For data collection, all researchers were trained so that the application of the questionnaire was as uniform as possible. Participants were approached individually and isolated to preserve their privacy, avoid embarrassment and ensure voluntary participation. The objectives of the project were presented to the participants and the delivery of the questionnaire took place according to the availability of each professional, setting a date and time in advance for data collection.

After accepting and signing the consent form, the researchers delivered the questionnaire and left the room, leaving the participant free to answer it. It took an average of 15 minutes to complete and participants were instructed to place the completed instruments in an unidentified envelope and then return them to the researcher.

The main hypothesis was to analyze whether the nurse's knowledge about the concepts of genetics and genomics applied to breast cancer differs according to the level of health care in which they work. The secondary hypothesis tested was whether the nurse's characteristics are different according to the place of work.

To test the hypothesis, the variables included were categorical. The independent variable was the place of work (outpatient and hospital). In the first hypothesis, the independent categorical variable was the place of work (outpatient and hospital); while the answer variables were questions about genetic/genomic knowledge (DNA concept, gene concept, genetic concept, chromosome concept, mutation concept), knowledge about cancer (cancer concept, cancer being sporadic or multifactorial, collection of family history in the approach of patients, knowing the genogram, knowing how to perform the genogram, referred the patient for genetic counseling) and knowledge about breast cancer (age group of mammographic screening in the general population; age group of mammographic screening with family risk; frequency of mammographic screening in the general population; clinical examination performed by a trained physician or nurse, annually, from 40 years old; most cases of breast cancer occur due to hereditary genetic alterations and genetic alterations associated with environmental factors; personal or family history of breast cancer in men increases the risk of hereditary breast cancer; early menarche, late menopause, nulliparity, hormonal changes, sedentary lifestyle, overweight, smoking and hormonal therapy are the main risk factors for sporadic breast cancer).

To test the secondary hypothesis, the independent variables were age group; training time; having taken a genetics course at graduation; the first contact with genetics/genomics; the highest academic degree. The response variable was the place of work (outpatient and hospital).

Data were entered into a database of the program using Epi Info software version 7.2.2.16. We performed descriptive analysis to characterize the study population using the Microsoft Excel® program. For categorical variables, absolute and relative frequencies were calculated. For continuous variables (age and time since graduation) an exploratory analysis was performed using the Minitab 14® program.

Considering the categorical nature of the variables, we applied Pearson's chi-square hypothesis tests and the G test. The G test was applied for the variables, expected frequencies were less than five. A significance level of $p<0.05$ in the Bioestat 5.3® program was adopted.

This study met all the requirements of Resolutions 466/12, 510/16 and 580/18 of the *Conselho Nacional de Saúde* and with the favorable opinion of the *Comitê de Ética em Pesquisa* of the *Hospital Universitário João de Barros Barreto*.

RESULTS

Eighty nurses participated in the research. They were women with a mean age of 42 years old (SD: ± 10.2; 95% CI: 39.7-44.3), between 23 and 63 years old, 35% of whom worked in secondary care and 65% in tertiary care. The time since training ranged from three to 39 years, with a mean of 17.5 years (SD: ± 8.8; 95% CI: 15.5-19.5), and the majority were experts in the two groups addressed (Table 1).

Table 1 shows the results of the analysis between the nurse's sociodemographic characteristics and the level of care in which they work. There was a difference between the level of care that nurses work and the variable first contact with genetics and/or genomics (p<0.001). For nurses working in hospitals, the highest proportion of the first contact was during academic training (71.2%), while for those working in outpatient care, the proportion was higher than the first contact in courses in general (75%).

Tables 2, 3, and 4 show the results of the analysis between knowledge of genetics and genomics, knowledge about cancer, and knowledge about breast cancer, respectively, in the place of action. Table 2 shows that there was a difference only between the concept of DNA and the level of care in which nurses work (p<0.0001).

The results in Table 3 demonstrate that there was a difference only between knowledge about the genogram and the level of attention (p=0.004). Nurses working in hospitals had a higher proportion of knowledge about the genogram (59.9%).

Table 4 shows that there was a greater difference between the studied variables. There was a difference between the level of performance and the variables of knowledge about the age group of mammographic screening with family risk (p=0.027); the clinical examination performed by a trained physician or nurse, annually, from 40 years old (p=0.005). Most cases of breast cancer occur due to hereditary genetic alterations (p=0.0004) and the main risk factors for sporadic breast cancer (p=0.0039).

DISCUSSION

Cancer is a genetic disease with international hegemony, which demands the integration of genetics and genomics concepts into clinical practice. Therefore, Nursing in this area has been a recurrent target of international studies.[5,6,15] In the Brazilian scenario, there is an absence of defined skills in the category, limited knowledge on the subject, and a lack of publications.

Table 1 - Proportion of nurse's characteristics according to the level of work. *Belém*, PA - Brazil 2018 (n=80)

Nurse characteristics	Secondary (n=28)		Tertiary (n=52)		Test	*p*-value
	n	%	n	%		
Age group						
23 to 37 years old	8	28.6	22	42.3	2.029[a]	0.362
38 to 52 years old	12	42.8	21	40.4		
53 to 63 years old	8	28.6	9	17.3		
Time of graduation						
3 to 19 years	14	50.0	29	55.8	0.122[a]	0.726
20 to 39 years	14	50.0	22	42.3		
Without answer	0	0.0	1	1.9		
Undergraduate genetics subject						
No	23	82.1	41	78.8	0.003[b]	0.953
Yes	5	17.9	11	21.2		
First contact with genetics/genomics						
Academic background: graduation to doctorate	4	14.3	37	71.2	50.260[b]	< 0.0001
Courses in general	21	75.0	1	1.9		
Others	3	10.7	11	21.2		
Without answer	0	0.0	3	5.7		
Highest academic degree						
Doctorate degree	1	3.6	2	3.9	1.127[b]	0.569
Specialist	22	78.6	35	67.3		
Master's degree	5	17.8	15	28.8		

[a] Chi-square. [b] G Test. Without response: not included in statistics.

Table 2 - Proportion of nurse's knowledge of genetics and genomics according to the level of performance. *Belém*, PA -Brazil 2018 (n=80)

Genetics/Genomics Knowledge	Secondary (n=28)		Tertiary (n=52)		Test	*p*-valor
	n	%	n	%		
DNA concept						
False	20	71.4	10	19.3	17.94[a]	< 0.0001
True	8	28.6	40	76.9		
Without answer			2	3.8		
Gene concept						
False	2	7.1	7	13.5	0.069[b]	0.791
True	22	78.6	45	86.5		
Without answer	4	14.3				
Genetics concept						
False	6	21.4	13	25.0	0.860[a]	0.654
True	22	78.6	37	71.1		
Without answer	0	0.0	2	3.9		
Chromosome concept						
False	1	3.6	3	5.8	0.011[b]	0.914
True	27	96.4	49	94.2		
Mutations concept						
False	4	14.3	7	13.5	0.057[b]	0.810
True	24	85.7	45	86.5		

[a] Chi-square. [b] G Test. did not respond: not included in statistics.

Table 3 - Proportion of knowledge about cancer in nurses according to the level of performance. Pará. 2018. *Belém*, PA -Brazil 2018 (n=80)

Knowledge about cancer	Secondary (n=28)		Tertiary (n=52)		Test	*p*-value
	n	%	n	%		
Cancer Concept		0.00				
False	7	25.00	5	9.6	2.181[b]	0.139
True	21	75.00	47	90.4		
Cancer being sporadic or multifactorial						
False	8	28.6	5	9.6	2.830[b]	0.092
True	20	71.4	43	82.7		
Without answer			4	7.7		
Collection of family history in the approach of patients						
No	5	17.9	16	30.8	0.971[a]	0.324
Yes	23	82.1	36	69.2		
Knowing the genogram						
No	23	82.1	23	44.2	8.255[a]	0.004
Yes	5	17.9	27	51.9		
Without answer			2	3.9		
knowing how to perform the genogram						
No	28	100	44	84.6	2.637[b]	0.104
Yes	0	0.00	6	11.5		
Without answer			2	3.9		
Referred patient for genetic counseling						
No	25	89.3	49	94.2	0.123[a]	0.725
Yes	3	10.7	3	5.8		

[a] Chi-square. [b] G Test. Without respond: not included in statistics.

Table 4 - Proportion of knowledge about breast cancer among nurses according to the level of performance. *Pará*. 2018

Knowledge about breast cancer	Secondary (N=28)		Tertiary (N=52)		Test	*p*-value
	n	%	n	%		
Age range of mammographic screening in the general population						
35-69 years old	14	50.0	25	48.1	0.005[a]	0.943
50-69 years old	14	50.0	27	51.9		
Age group of mammographic screening with familial risk						
35-69 years old	11	39.3	47	90.4	7.173[b]	0.027
50-69 years old	7	25.0	5	9.6		
60-79 years old	1	3.6				
Without answer	9	32.1				
Frequency of mammographic screening in the general population						
1 year	9	32.1	29	55.7	4.417[b]	0.109
2 years	16	57.2	20	38.5		
3 years	2	7.1	1	1.9		
Without answer	1	3.6	2	3.9		
Clinical examination performed by a trained physician or nurse, annually, from 40 years old						
No	0	0.00	12	23.1	7.845[b]	0.005
Yes	28	100	39	75.0		
Without answer	0		1	1.9		
Most cases of breast cancer occur due to hereditary genetic alterations						
No	25	89.3	24	46.1	12.551[b]	0.0004
Yes	3	10.7	26	50.0		
Without answer			2	3.9		
Most cases of breast cancer occur due to genetic alterations associated with environmental factors						
No	8	28.6	14	26.9	0.043[a]	0.834
Yes	20	71.4	36	69.2		
Without answer			2	3.9		
Personal or family history of breast cancer in men increases the risk of hereditary breast CA						
No	4	14.3	11	21.1	0.206[b]	0.649
Yes	24	85.7	41	78.9		
Early menarche, late menopause, nulliparity, hormonal changes, sedentary lifestyle, overweight, smoking, and hormonal therapy are the main risk factors for sporadic breast cancer						
No	6	21.4	4	7.7	4.235[b]	0.039
Yes	13	46.4	48	92.3		
Without answer	9	32.2				

[a] Chi-square. [b] G Test. Without response: not included in statistics.

Two Brazilian studies found weaknesses in knowledge and clinical applicability when assessing knowledge of genetics and genomics among nurses in primary[12] and tertiary[13] care, separately. Our study was the first to compare knowledge about genetics and genomics applied to BC in nurses from different levels of care.

The results showed a predominance of specialist nurses, with a mean age of 42 years old and 17 years of experience in tertiary care. This professional profile was similar to previous studies.[13,17]

The first contact with basic concepts of genetics and genomics was divergent among participants (<0.0001).

This discrepancy arises from the non-mandatory provision of the discipline of genetics or oncology by higher education institutions, which contradicts curricular principles based on the SUS, the epidemiological profile, and the labor market[18], limiting the empowerment of nurses in research and practice clinics.

Basic knowledge about the concepts of genetics and genomics was demonstrated between the two groups (Table 2) and most participants were unaware of the genogram. This scenario is alarming and multifactorial, as it reflects failures in academic training and professional performance arising from the delay in international guidelines15 and unsatisfactory implementation of existing national policies.[7-9]

Second, the genogram is a useful tool for collecting data on the patient's family history. By neglecting its application, the opportunity to identify individuals at risk is lost.[19,20] However, the practice of genetic counseling is still unequal in the country, focused on the Brazilian southern and Brazilian regions.[11]

In this study, we noted that tertiary care (hospital) nurses made a mistake when stating that inherited genetic alterations are associated with sporadic cancer. Knowledge gaps on the topic were also identified in a study from the state of Rio Grande do Sul[13] which showed 74.9 and 66.4% of correct answers regarding the knowledge "characteristics of hereditary breast cancer" and "high--risk indicators of developing hereditary breast cancer", respectively.

The emphasis on correct answers among nurses in tertiary care (hospital) is related to the frequency of more complex clinical experiences[21], even if they are still passive, neglectful of the genetic basis of the disease6 and without discerning between sporadic and hereditary disease.[4,5]

Although there are no national guidelines that define essential skills in genetics and genomics for nurses, these professionals experience international cancer therapeutic guidelines and follow protocols that require specific, advanced, and personalized skills regarding the patient's genetic alterations.[5]

In this study, secondary care professionals had a lower rate of correct answers regarding breast cancer (risk factors and screening), but the scarcity of studies on the topic hindered the comparison of these results. The guidelines for the BC have changed over time the non-recommendation of self-examination, the age range of clinical examination and mammography, and their frequencies. Currently, mammographic screening is biennial in women between 50 and 69 years old at general risk.[7]

Alternatively, there is no definition of mammographic screening criteria for those at increased risk[7], whose changes in the guidelines have already moved between biannual, annual, and not recommended. It is an act of neglect by the Ministry of Health to the younger woman at risk for multiple cancers during her lifetime. The decision to screen against BC is up to the oncologist and/or the shared decision of the woman in this condition, considering international guidelines that are based on the penetrance of the germline mutation identified in the genetic test to define the conduct.[22]

Furthermore, there is a divergence of this target age group between the Ministry of Health, considering the radiation risk and cost-benefit, the *Instituto Nacional do Câncer* (INCA), and medical societies that purely follow international clinical trials. Paradoxically, a recent ordinance prioritized mammography for women 35 years old or older at high risk for BC.[23] This heterogeneity of target age groups generates weakness in knowledge and perhaps in the guidance of nurses related to the promotion, prevention, and surveillance of breast change in screening, in primary care[12] and throughout the BC care network.[24]

We need to highlight two critical factors in this context of knowledge on the topic among the participants. First, Brazilian public policies for Oncology allow the work of general practitioners at all levels of health, so the training of these professionals is imperative. Second, the State and Municipal Health Secretariats create and use their guidelines and protocols that differ from the Ministry of Health protocols[25], generating non-standardization of care conducts.

The limitations found in this study relate to the sample size, the lack of comparison of nurse's knowledge between general professionals or specialists, the scarcity of studies on the topic to compare the realities experienced between the national and international scenario, and the heterogeneity and dynamism of the guidelines for the BC.

CONCLUSION

We identified limited knowledge about the concepts of genetics and genomics applied to the BC in nurses working in secondary and tertiary care, which can negatively impact quality care.

This gap in the specific knowledge of nurses in the North region reinforces the need for emergency professional training, focused on the care process and current health policies at all levels of health care.

The strengthening of the permanent education policy in the SUS is essential to expand the technical performance capacity within the system given the morbidity and mortality rates from breast cancer in the state.

We expect that such results may generate reflections on the curricular reconfiguration of state Higher Education Institutions for the insertion of Oncology and/or Genetics subjects, given their epidemiological profile and the need for qualified local labor.

Finally, we believe that, as this is a current and little explored theme, additional studies in this area are needed to raise more information regarding the content and directly contribute to teaching, research and extension, and to better promote quality of care.

REFERENCES

1. Global Burden of Disease Cancer Collaboration. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2017. JAMA Oncol. 2019[cited 2021 Jan 2];5(12):1749-68. Available from: https://jamanetwork.com/journals/jamaoncology/fullarticle/2752381

2. Instituto Nacional de Câncer José Alencar Gomes da Silva (INCA). A situação do câncer de mama no Brasil: síntese de dados dos sistemas de informação. Instituto Nacional de Câncer José Alencar Gomes da Silva. Rio de Janeiro: INCA; 2019[cited 2020 Jun 15]. Available from: https://www.inca.gov.br/sites/ufu.sti.inca.local/files/media/document/a_situacao_ca_mama_brasil_2019.pdf

3. Vaz DWN, Oliveira JD, Santos Filho LCC, Miranda TLKS, Evangelista HI, Silva JB. Descrição epidemiológica de pacientes diagnosticados com CA de mama no Estado do Pará. Rev Bras Educ Saúde. 2020[cited 2020 Apr 20];10(2):86-90. Available from: https://editoraverde.org/gvaa.com.br/revista/index.php/REBES/article/view/7788

4. Aguiar FR. Produção de Cuidado na Rede de Atenção ao Câncer de Mama: revisão integrativa. Sanare. 2018[cited 2020 Mar 20];17(01):84-92. Available from: https://doi.org/10.36925/sanare.v17i1.1226

5. Biancolella M, Testa B, Salehi LB, D'Apice MR, Novelli G. Genetics and Genomics of Breast Cancer: update and translational perspectives. Review Semin Cancer Biol. 2020[cited 2021 Jan 2];S1044-579X(20)30079-1. Available from: https://pubmed.ncbi.nlm.nih.gov/32259642/

6. Flynn S, Cusack G, Wallen GR. Integrating Genomics into Oncology Practice. Review. Semin Oncol Nurs. 2019 Feb[cited 2021 Jan 2];35(1):116-30. Available from: https://pubmed.ncbi.nlm.nih.gov/30686495/

7. Ministério da Saúde (BR). Portaria conjunta Nº 04, de 23 de janeiro de 2018. Aprova as Diretrizes Diagnósticas e Terapêuticas do Carcinoma de Mama. Brasília: MS; 2018[cited 2021 Feb 2]. Available from: https://portalarquivos2.saude.gov.br/images/pdf/2018/fevereiro/07/PORTARIA-no-04-PCDT.carcinoma.mama.2018.pdf

8. Ministério da Saúde (BR). Portaria nº 199, de 30 de janeiro de 2014. Institui a Política Nacional de Atenção Integral às Pessoas com Doenças Raras. Brasília: MS; 2014. Available from: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2014/prt0199_30_01_2014.html

9. Ministério da Saúde (BR). Portaria nº 81 de 20 de janeiro de 2009. Política Nacional de Atenção Integral em Genética Clínica. Brasília: MS; 2009[cited 2020 Apr 20]; Available from: http://dtr2001.saude.gov.br/sas/PORTARIAS/Port2009/GM/GM-81.html

10. Conselho Federal de Enfermagem. Resolução nº468/2014. Atuação do enfermeiro no aconselhamento genético. Brasília: Cofen; 2014[cited 2020 Apr 20]. Available from: http://www.cofen.gov.br/wp-content/uploads/2015/01/RESOLUCAO-COFEN-No-0468-2014-ANEXO-ACONSELHAMENTO-GENETICO.pdf

11. Cardoso MCV, Cordeiro Júnior DA. Enfermagem em genômica: o aconselhamento genético nas práticas assistenciais. REME - Rev Min Enferm. 2016[cited 2020 Mar 20];20:e956. Available from: https://doi.org/10.5935/1415-2762.20160025

12. Lopes Júnior LC, Carvalho Júnior PM, Ferraz VEF, Nascimento LC, Riper MV, Flória-Santos M. Genetic education, knowledge and experiences between nurses and physicians in primary care in Brazil: A cross-sectional study. Nurs Health Sci. 2017[cited 2020 Mar 10];19(1):66-74. Available from: https://doi.org/10.1111/nhs.12304

13. Prolla CMD, Silva PS, Netto CBO, Goldim JR, Ashton-Prolla P. Conhecimento sobre câncer de mama e câncer de mama hereditário entre enfermeiros em um hospital público. Rev Latino-Am Enferm. 2015[cited 2020 Mar 10];23(1):90-7. Available from: https://doi.org/10.1590/0104-1169.0185.2529

14. Pacheco RL, Martimbianco ALC, Garcia CM, Logullo P, Riera R. Guidelines para publicação de estudos científicos. Parte 2: Como publicar estudos observacionais (coorte, caso-controle e transversal). Diagn Tratamento. 2017[cited 2020 Mar 10];22(30):121-6. Available from: http://docs.bvsalud.org/biblioref/2017/08/848018/rdt_v22n3_121-126.pdf

15. Jenkins J. Essential Genetic and Genomic Nursing Competencies for the Oncology Nurse. Semin Oncol Nurs. 2011[cited 2021 Jan 2];27(1):64-71. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3059123/

16. Perroca MG. Desenvolvimento e validação de conteúdo da nova versão de um instrumento para classificação de pacientes. Rev Latino-Am Enferm. 2011[cited 2021 Jan 2];19(1):[09 telas]. Available from: https://www.scielo.br/pdf/rlae/v19n1/pt_09.pdf

17. Conselho Federal de Enfermagem (COFEN). Perfil da Enfermagem no Brasil. Brasília. 2013[cited 2020 Mar 16]. Available from: http://www.cofen.gov.br/perfilEnfermagemm/index.html

18. Conselho Nacional de Saúde (BR). Resolução 573 GM/MS Nº de 31 de janeiro de 2018: aprova as recomendações do Conselho Nacional de Saúde (CNS) à proposta de Diretrizes Curriculares Nacionais (DCN) para o curso de graduação Bacharelado em Enfermagem. Brasília: CNS; 2018[cited 2021 Jan 16]. Available from: https://conselho.saude.gov.br/resolucoes/2018/Reso573.pdf

19. Lopez V. Genetic Testing: Do Cancer Care Nurses Have a Role? Asia Pac J Oncol Nurs. 2018[cited 2020 July 16];5(4):391-3. Available from: https://doi.org/10.4103/apjon.apjon_23_18

20. Vecchio MM. Breast cancer screening in the high-risk population. Asia Pac J Oncol Nurs. 2018[cited 2020 July 16];(5):46-50. Available from: https://doi.org/10.4103/apjon.apjon_53_17

21. Sales LAP, Lajus TBP. Aconselhamento genético em oncologia no Brasil: realidade e perspectivas. Rev Med. 2018[cited 2020 July 06];97(5):448-53. Available from: http://dx.doi.org/10.11606/issn.1679-9836.v97i5p448-453

22. Geuzinge HA, Obdeijn IM, Rutgers EJT, Sepideh S, Ritse MM, Jan CO, *et al*. Cost-effectiveness of Breast Cancer Screening With Magnetic Resonance Imaging for Women at Familial Risk. JAMA Oncol. 2020[cited 2021 Feb 2];6(9):1381-9. Available from: https://jamanetwork.com/journals/jamaoncology/article-abstract/2768633

23. Ministério da Saúde (BR). Portaria nº 3.712 de 22 de dezembro de 2020. Institui, em caráter excepcional, incentivo financeiro federal de custeio para o fortalecimento do acesso às ações integradas para rastreamento, detecção precoce e controle do Câncer no Sistema Único de Saúde. Brasília: MS; 2020[cited 2021 Feb 2]. Available from: https://www.in.gov.br/web/dou/-/portaria-gm/ms-n-3.712-de-22-de-dezembro-de-2020-295788198

24. Goldman RE, Figueiredo EN, Fustinoni SM, Souza KMJ, Almeida AM, Gutiérrez MGR. Rede de Atenção ao Câncer de Mama: perspectiva de gestores da saúde. Rev Bras Enferm. 2019[cited 2020 July 30];72(Suppl 1):274-81. Available from: https://doi.org/10.1590/0034-7167-2017-0479

25. De Cesaro BC, Vasconcellos VPC, Scola BT. Heterogeneidade nas diretrizes do câncer de mama: Ministério da Saúde e Secretarias Municipais de Saúde. Rev Fac Ciênc Méd Sorocaba. 2019[cited 2020 July 06];21(1):22-7. Available from: https://doi.org/10.23925/1984-4840.2019v21i1a5