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# Breast cancer understanding among university students: A rapid review of cross-country comparisons

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Abstract

Background: In alignment with the World Health Organization’s Global Breast Cancer Initiative objectives, this rapid review sought to determine the extent to which breast cancer understanding is being researched globally in undergraduate student populations, and review recent findings, to inform policy makers and practitioners on the baseline level of student understanding by world region.

Methods: Four academic databases were searched. 114 studies meeting the search criteria were assessed based upon Strengthening the Reporting of Observational Studies in Epidemiology reporting guidelines and comprehensiveness of coverage for the factors of interest. 33 were selected as representing quality research from all world regions producing recent research of this topic. Their findings were narratively synthesised.

Results: The majority of recent research emanates from regions with accelerating breast cancer mortality rates, corresponding with lower economic resources, primarily within Africa and Asia. Most focus on breast cancer understanding in female participants, with little data available for males or minority gender groups. Disparity between medical and non-medical student breast cancer understanding is widely reported, though breast cancer understanding is found to be inadequate for most students. Interventions to improve breast cancer understanding indicate promising results, though a lack of standardised measures, together with inadequate reporting of effect sizes, makes meta-analysis of prevailing data challenging.

Conclusion: Evidence suggests undergraduate student breast cancer understanding globally is inadequate and indicates the necessity of increased rigour in research design and reporting to facilitate reliable knowledge generation. Systematic review is recommended to widen the scope and depth of this rapid review in support of WHO targets. .

*Keywords: breast cancer, breast self examination, students, public health, breast cancer awareness*

# Introduction

Worldwide Breast Cancer (BC) has become the leading cause of Cancer 1 and accounted for 2.3 million cases in 2021 2. It is estimated that this figure will reach 11 million by 2030 3. To address this major disease burden the World Health Organization (WHO) launched The Global Breast Cancer Initiative in 2021, with health promotion for early detection prioritised 4. Higher rates of survival and recovery have been associated with timely diagnosis and treatment 5, facilitated through BC understanding. BC understanding is here conceptualised as BC awareness (BCA), which includes general awareness of the prevalence of the disease, and BC knowledge, including scientifically informed knowledge of heritable and environmental BC risk factors, symptoms, prevention through lifestyle choices and clinical screening, plus treatment options. Further, breast self-examination (BSE), although of limited efficacy at lowering BC mortality 6, 7, is the primary screening technique for signs of BC and supports early detection in many economically developing countries 8. A recent systematic review of the literature found that BC awareness and screening knowledge in women are lower in developing countries and further interventions are needed 9. However, since BC understanding is expected to necessitate different focus across different age groups, it is important to gain insight into different age cohorts to adequately assess progress towards WHO targets. It is the objective of the present study to review recent findings to determine the extent to which BC understanding is being researched throughout the world in undergraduate student populations. Findings will inform policy makers and practitioners on the baseline level of student BC understanding by world region. Additionally, insights from this review will help progress BC understanding toward WHO targets, informing public health interventions well-targeted for this under-researched population in this area.

Undergraduate student populations are at lower risk of BC given average age 10 so are not commonly advised to attend clinical screening. However, they represent an important target for BC understanding, since their high lifetime risk can be effectively reduced through knowledge of risk factors 11, 12, plus the advantage early detection through awareness of screening at an appropriate age can provide 4. In addition, world regions have varying age of BC diagnosis, with averages in some regions, such as Western Asia, up to ten years earlier than others 13, placing some undergraduate students at greater risk depending on location. Student BC understanding has previously been shown to be very poor and variable by geographical region 14, 15. As the first cohort to benefit from the WHO’s Global Breast Cancer Initiative it is crucial to determine the baseline of prevailing BC understanding and behaviours in this population globally at this timepoint. By reviewing contemporary evidence of BC understanding in the undergraduate student population globally this study aims to provide much needed insight into prevalence of recent research in this area for this well-defined population and provide baseline data to inform future assessment of Global Breast Cancer Initiative progress. The present review additionally aims to document whether sex and course of study differences are reported in BC understanding, since these may highlight important areas for future research and intervention, and assess prevailing measures in use to determine BC understanding, to provide initial indication of the possibility of meta-analysis.

*Summary of Research Aims*

Existing reviews addressing some aspects of these research aims are either based upon data that is out of date considering recent dramatic societal changes, such as the fourth industrial revolution, and advances in knowledge of genetic risk for BC 14, focused exclusively on particular regions such as Asia, Africa and the Americas 15, or exclusively focused on female populations and not limited to undergraduate students 9, 16. In summary, the aims in the current study are not answered by existing reviews, and can be stated as four novel research questions. For BC understanding of undergraduate students:

1. In what regions are these factors being actively researched, with peer-reviewed findings published within the previous five years, and what might be contributing to between region differences?

2. To what extent are sex or gender differences reported upon?

3. How is inclusion of medical and non-medical students represented and what are differences in findings between these groups?

4. Do the measures being used to assess these factors facilitate effective meta-analysis?

In answering these research questions, transferrable evidence-based good practices identified can inform future research, policy and interventions.

Methods

To address the research questions in a timely manner, demanded by the need to baseline prevailing undergraduate student BC understanding and behaviour, rapid review methodology was chosen. Rapid review follows systematic review procedures omitting those criteria deemed appropriate to the research aims based upon time constraints and resources 17. The research team, which included specialists in the fields of oncology, breast health behavior, and student wellbeing, formulated a rapid review protocol in accordance with prevailing Cochrane rapid review guidance 17 to answer the research questions. The protocol informed each step of the review process. Searches took place on 10th September 2022. Following Cochrane recommendations for rapid review 17 databases included in the search were Embase and MEDLINE to encompass the specialist health literature, PsycINFO to extend search to social science findings and Google Scholar to capture remaining studies from heterogenous academic disciplines. To account for synonymous terms 18, identified through a preliminary scoping exercise, iterations of the search included the terms ‘breast cancer awareness students’, ‘breast cancer understanding students’, ‘breast cancer knowledge students’, ‘breast cancer awareness student’, ‘breast cancer understanding student’, and ‘breast cancer knowledge student’. Results were manually screened for duplicates and eligibility based upon the study protocol, informed by Cochrane rapid review constraints 17: full-text peer-reviewed English articles, published between January 1st 2017 and 10th September 2022, quantitatively investigating university student BC understanding, BSE knowledge and behaviours, and BC screening attendance, were included. Screening details are reported in Figure 1. To provide a representative sample of the full breadth of research in this area whilst ensuring coverage of all global regions returned in the search, the resultant set of studies (n=114) were assessed for quality based upon Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines 19 and comprehensiveness of coverage for the factors of interest based upon the research questions. All searching and screening underwent peer-review by the research team. Data extraction and quality assessment were assessed for inter-rater reliability between two researchers based upon a sample prior to commencing extraction and assessment against the entire set of studies included in the review 20. The resultant 33 studies selected for narrative synthesis are detailed in Appendix A Table 1.

[INSERT Figure 1 Here]

Figure 1. PRISMA Searching and Screening Flow Diagram 21

## Results

*Regions Actively Generating Research of Student BC Understanding*

The identified articles in Appendix A Table 1present the regions generating empirical breast cancer research since 2017; originating from, Western Asia (n=6), Eastern Asia (n=5), Southern Asia (n=5), South-Eastern Asia (n=5), Eastern Europe (n=3), South America (n=2), Northern Africa (n=2), Eastern Africa (n=1), Middle Africa (n=1), Northern America (n=1), Western Africa (n=1), and a multi-national collaboration (n=1) in which Turkish students demonstrated more BC understanding than Polish students 22.

Of the 33 selected articles, there are 27 descriptive cross-sectional studies, characterising the prevalence of breast cancer awareness, five quasi-experimental interventions estimating the causal impact of specific breast cancer interventions, and one BCA scale development study 23. All explored breast cancer awareness and knowledge, 30 studies addressed BSE, and 6 studies focused on attitudes towards breast cancer awareness. Only two studies, each from Eastern Europe, reported BC screening attendance. Kryvoviaz et al. 24 reported 46.3% of female participants as regularly visiting a gynaecologist and in Zuzak et al. 25 69.01% of female participants reported having attended their first gynaecologist visit.

Sample sizes of 100-800 are typical of the selected studies, yet three had above 1000 26-28. Studies cited average ages between 18 years and 24 years, with samples ranging from 17 years to 37 years.

*Sex and Gender Representation in Recent Research of Student BC Understanding*

The majority of the studies (n=21) included women only. There were only nine studies which included both women and men participants and three studies which included only men. There were no studies which recorded a wider spectrum of gender. In the nine studies, which included men and women, the largest gender group were all reported as female. Moreover, seven of these did not make comparisons of BC knowledge between gendered groups. One study excluded questions from male participants in their data collection tool such as whether they had performed BSE 25. The remaining three studies did make gender comparisons, however, two reported no significant difference in BC knowledge 29, 30. Salim et al. 31 did report a significant difference in total knowledge in BC prevalence and detection, with females more knowledgeable. Although knowledge about tools for BC detection also showed no significant differences between sexes. Two of the three studies which included only male participants focused on BC in males only. Faria et al. 32 compared their knowledge to wider data which did not identify a significant difference. However, their study sample did report a lack of knowledge of BSE (69%) and BC signs and symptoms (77%). Whereas Saritas et al. 33 reported a higher awareness of BC (83%) in their male sample. The remaining study, which only included participating men, reported poor knowledge of BC in women and worryingly it reported over half its sample believed BC was contagious (54%) 34.

*Medical and Non-medical Discipline Representation in Recent Research of Student BC Understanding*

The university courses varied throughout the 33 identified articles and focused on a variety of medical and non-medical students. Nine articles included both medical and non-medical students and used cross-sectional studies to investigate BC. The consensus within seven of the articles was that there was greater knowledge about BC among the medical students compared to the non-medical students 25, 27, 29, 34-37 . However, low rates of BSE were reported for both medical and non-medical students, with no significant difference between the groups for performing examinations 27, 29. Additionally, studies in Western Asia reported all the students had an overall weak to poor knowledge of the topic area 31, 38.

Seventeen of the identified articles investigated either medical or non-medical students. Twelve articles investigated medical students' knowledge, understanding and awareness of BC. There was a high (98% 39, 95% 24, 67.58% 40) to low (22.5% 41) spectrum of knowledge, awareness and understanding reported among the medical students 42-45. Despite the reported range of BC knowledge, further studies found low BSE rates (83.7% not practicing BSE 33) or incorrectly practicing breast self-examinations, for example, lack of frequency and appropriate time to practice (71.5%, 41) among the medical students. Two additional studies conducted effective interventions that increased BC knowledge among African (t=29.047, P=0.000) 46 and Southeastern Asian (92% improved BC knowledge) 47 medical students. Five of the articles focused on non-medical university students, the studies reported that more BC understanding was needed 26 48 49 50). Four articles included interventions for non-medical students and all studies reported an increase in knowledge and awareness after the interventions 51 52 53 54.

*Measures in Use to Determine Student BC Understanding, BSE and BC Screening Attendance*

Of the 33 studies selected for comprehensiveness of coverage of the factors associated with the research aims, including quantitative measures of BCA, BSE and BC screening, all incorporated some measure of BCA. Standardised measures employed were the Breast Cancer Awareness Measure (BCAM) 55 (n=2), translated versions of BCAM (n=2), Champion’s Health Belief Model Scale versions 56 (n=2), and the American College of Obstetricians and Gynaecologists Updated Clinical Management Guidelines (n=1). The remainder of the studies employed novel scales, with only 13 reporting scale reliability and / or validity properties. Of the novel scales for which psychometric properties were reported only five reported coefficients for the individual scales, the remainder reported coefficients for the aggregated scales. Cronbach’s alpha for the novel scales ranged between .53 and .89. The majority, 30, included measures of BSE knowledge and 20 included measures of BSE practice, though not all reported on BSE practice levels. The two studies measuring BC screening attendance used single item non-standardised questionnaire items. The majority of studies did not report outcome effect size.

## Discussion

Following search of four databases, of 114 studies meeting the search criteria 33 were selected as representing quality research from all world regions producing recent BC understanding research. Their findings were narratively synthesised. Results indicate the majority of recent research emanates primarily from Africa and Asia. The majority of studies focus on BC understanding in female participants, with little data available for males or minority gender groups. Disparity between medical and non-medical student breast cancer understanding is widely reported, though BC understanding is found to be inadequate for most students. Interventions to improve BC understanding indicate promising results. Different standardised measures were used in seven studies and the remainder deployed novel scales, not always reporting psychometric properties. Effect sizes were not reported for the majority of studies. These findings will now be discussed.

Addressing the first research question, research into BC understanding in students globally demonstrates correspondence between regions actively researching BC understanding with regional increase of BC mortality 2. A significant proportion of nearly 24% of all BC cases occurs in regions of Asia, with the highest rates seen in China, Japan, and Indonesia, despite lower screening rates in these regions than those with the highest incidence, such as Europe and North America 57. Similarly, accelerating BC rates, including high mortality to incidence ratio, are prevalent in the African and South Asian regions producing recent BC understanding research 2. Although economically developed countries have demonstrated consistently higher estimated BC incidence compared to developing countries over the last five years 2 58, in low- and middle-income countries, the mortality rates are rising due to a lack of screening and treatment resources 59. These circumstances indicate why such regions may be producing recent empirical BC research and promoting BSE for this age group. Although BC mortality rates are falling in regions for which there is no active research into BC understanding, such as Northern and Western Europe, BC disease burden remains significant and a leading cause of female mortality in these regions 2, indicating the requirement for renewed research investment in BC understanding in these regions to accord with the WHO Global Breast Cancer Initiative.

In relation to BC understanding across genders, the majority of evidence does not consider comparing or measuring BC understanding of men, reflecting a trend in the general BC understanding literature, e.g. Anastasi & Lusher 11, Peacey et al. 14, Wang et al. 9, and older assessments of student BC understanding 15. Only three studies of the total 33 made such comparison 29-31 and findings are mixed, preventing meaningful interpretation. Whilst female sex is the strongest BC risk factor with approximately 0.5-1% of the total diagnosed occurring in men 60, it does present risk of male mortality 61, and it is still crucial to examine men’s understanding of BC in women. This is because women diagnosed with BC also impacts on the mental health and wellbeing of men, as family members and partners 62 63. Additionally, a husband's BC knowledge has been identified as a significant factor to their wives’ practices and attitudes towards BC 64. Therefore, increasing men’s knowledge of BC will, in turn, promote health preventative behaviors in women. It is also crucial for both women and men to have knowledge of male BC diagnosis. This is because culturally it is seen as a woman’s disease and stigmatisation in male BC patients is high 65. The findings have also highlighted that research considering the needs of wider gender identities is insufficient. Trans women are also at an increased risk of BC during hormone treatment and therefore it is important research is inclusive of minority gender groups to ensure any recommendations as a result meet all gender needs 66.

The findings suggest the medical students and non-medical students' knowledge, awareness and self-examination rates ranged from low to high. However, the non-medical students displayed less knowledge and awareness than the medical students, furthermore, a portion of the students had never heard of BC or BSE. Medical students are taught about Cancer (and BC) and the associated risk factors within the course and curriculum 67, however, non-medical students may not have any direct education about the topic. The interventions suggested that they were effective in increasing knowledge and awareness of BC and would be a benefit to medical and non-medical students. Interventions to enhance student BSE practice have preliminary support in regions for which BSE is recommended for this population.

Lastly, an assessment of BC understanding remains to be developed. The use of validated reliable psychometric scales is essential in ascertaining levels of cancer awareness 68. One established scale is the BCAM validated by Linsell et al 55. Originally, this scale was assessed reliable to evaluate BC understanding among UK women. Since the development, BCAM has been tested for its validity and reliability among different populations 69-73. More recently, the African Women Awareness of CANcer (AWACAN) tool was developed 74, however the BCAM has been used more commonly across the globe including Africa. BCAM consists of eight questions with a total of 31 items assessing awareness and knowledge of BC risk factors, symptoms, BSE and clinical screening options. Indeed, the presence of one established scale helps researchers and practitioners to determine which tool to employ to assess the awareness of breast cancer in their target population. However, the risk is if the scale does not fit or is unsure to fit to a context, the researchers and practitioners have no other way to assess. Moreover, as seen in mental health research 75, 76, people’s awareness can change over time. Developing a timely scale or updating an already-developed scale is important. However, to date, an investigation on tools to assess BC understanding remains to be conducted.

Lack of inclusion of BC screening attendance data to measure behaviour in all but two studies may reflect regional and national differences in public health policy. For many regions consensus exists that female BC screening should not commence until the 50th year of life, thus outside the range of participants reported in the studies reviewed

### *Limitations*

Several limitations must be noted that may affect the generalisability of this review. English language articles only were chosen due to the standardisation of English as the primary language scientific journals favour, however inclusion of articles available in all languages would broaden the evidence base. Risk of methodological and researcher bias was controlled as far as practicable but limitations of rapid review methodology may have influenced study selection. Therefore it is an important recommendation of this review that future systematic reviews build upon the evidence presented here to deepen the knowledge in this area to best promote the reduction of BC mortality.

### *Conclusion*

This review undertook a search of the literature in order to answer four research questions regarding BC understanding among student populations worldwide. It was found that research is almost exclusively being generated in economically developing world regions in which BC incidence is increasing and for which BC mortality is high. Prevailing evidence includes predominantly female samples though a good representation of medical and non-medical students. Although standardised instruments exist to measure BCA and BSE they are seldom used in the regions generating research output in this area. In all these regions recent evidence suggests BC understanding is inadequate. Interventions to improve BCA and BSE indicate promising results and highlight the necessity of increased rigour in design and reporting to facilitate reliable knowledge generation.

Since incidence of BC is rising globally 77 the lack of recent empirical studies into critical factors of risk reduction for student populations in economically developed nations are concerning. Although BC mortality rates are lower in these regions than those seen to be producing recent relevant output 77 there is still a compelling case for more knowledge to be created to ascertain the effectiveness of their public health campaigns, answering the WHO’s Global Breast Cancer Initiative recommendations 4.

In regions for which incidence is increasing most rapidly there are a wealth of descriptive studies, consistently finding low BC understanding, indicating well-designed RCT intervention studies are now required to determine effective means of improving BC understanding for all student groups, in a contextually appropriate manner depending upon region 57.

When investigating BC knowledge further research is needed to understand the needs of all gender groups irrespective of BC diagnosed in men or women. This will ensure all needs are understood in terms of the promotion of health preventative behaviors and shared recommendations for wider families and communities.

The low level of detail of scale properties and outcome effect sizes in the majority of studies reviewed challenges the possibility of reliable meta-analysis of extant findings. To accurately gauge BCA, BSE practice, and efficacy of interventions, more rigorous reporting is recommended, including the development and adoption of culturally sensitive standardised measures.

To address the limitations of rapid review further systematic review is recommended to provide comprehensive coverage of the literature in support of WHO targets.

Declarations

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## References

1. Moslemi M, Moradi Y, Dehghanbanadaki H, Afkhami H, Khaledi M, Sedighimehr N, et al. The association between ATM variants and risk of breast cancer: a systematic review and meta-analysis. BMC Cancer. 2021;21(1):27. DOI: 10.1186/s12885-020-07749-6

2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3):209-49. DOI: 10.3322/caac.21660

3. Benson JR, Jatoi I. The global breast cancer burden. Future Oncol. 2012;8(6):697-702. DOI: 10.2217/fon.12.61

4. World Health Organization. The Global Breast Cancer Initiative (GBCI): World Health Organization; 2022. Available from: <https://www.who.int/publications/m/item/the-global-breast-cancer-initiative-gbci>.

5. Ginsburg O, Rositch AF, Conteh L, Mutebi M, Paskett ED, Subramanian S. Breast Cancer Disparities Among Women in Low- and Middle-Income Countries. Current Breast Cancer Reports. 2018;10(3):179-86. DOI: 10.1007/s12609-018-0286-7

6. Hackshaw AK, Paul EA. Breast self-examination and death from breast cancer: a meta-analysis. Br J Cancer. 2003;88(7):1047-53. DOI: 10.1038/sj.bjc.6600847

7. Weiss NS. Breast Cancer Mortality in Relation to Clinical Breast Examination and Breast Self-Examination. The Breast Journal. 2003;9(s2):S86-S9. DOI: 10.1046/j.1524-4741.9.s2.9.x

8. Albeshan SM, Hossain SZ, Mackey MG, Brennan PC. Can Breast Self-examination and Clinical Breast Examination Along With Increasing Breast Awareness Facilitate Earlier Detection of Breast Cancer in Populations With Advanced Stages at Diagnosis? Clinical Breast Cancer. 2020;20(3):194-200. DOI: 10.1016/j.clbc.2020.02.001

9. Wang Y-J, Wang F, Yu L-X, Xiang Y-J, Zhou F, Huang S-Y, et al. Worldwide review with meta-analysis of women’s awareness about breast cancer. Patient Education and Counseling. 2022;105(7):1818-27. DOI: 10.1016/j.pec.2021.12.012

10. Hosseini MS, Arab M, Nemati Honar B, Noghabaei G, Safaei N, Ghasemi T, et al. Age - specific incidence rate change at breast Cancer and its different histopathologic subtypes in Iran and Western countries. Pak J Med Sci. 2013;29(6):1354-7. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3905388/>

11. Anastasi N, Lusher J. The impact of breast cancer awareness interventions on breast screening uptake among women in the United Kingdom: A systematic review. Journal of Health Psychology. 2019;24(1):113-24. DOI: 10.1177/1359105317697812

12. Britt KL, Cuzick J, Phillips K-A. Key steps for effective breast cancer prevention. Nature Reviews Cancer. 2020;20(8):417-36. DOI: 10.1038/s41568-020-0266-x

13. Naja F, Nasreddine L, Awada S, El Sayed Ahmad R, Hwalla N. Nutrition in the Prevention of Breast Cancer: A Middle Eastern Perspective. Frontiers in Public Health. 2019;7. DOI: 10.3389/fpubh.2019.00316

14. Peacey V, Steptoe A, Davídsdóttir S, Baban A, Wardle J. Low levels of breast cancer risk awareness in young women: An international survey. European Journal of Cancer. 2006;42(15):2585-9. DOI: 10.1016/j.ejca.2006.03.017

15. Peltzer K, Pengpid S. Awareness of breast cancer risk among female university students from 24 low, middle income and emerging economy countries. Asian Pac J Cancer Prev. 2014;15(18):7875-8. DOI: 10.7314/apjcp.2014.15.18.7875

16. Almutairi AH, Tamrin SBBM, Wirza R, Ahmad NB. Systematic Review on Knowledge and Awareness of Breast Cancer and Risk Factors Among Young Women. Advances in Bioscience and Clinical Medicine. 2019;7(1):7. DOI: 10.7575/aiac.abcmed.v.7n.1p.41

17. Garritty C, Gartlehner G, Nussbaumer-Streit B, King VJ, Hamel C, Kamel C, et al. Cochrane Rapid Reviews Methods Group offers evidence-informed guidance to conduct rapid reviews. J Clin Epidemiol. 2021;130:13-22. DOI: 10.1016/j.jclinepi.2020.10.007

18. Kotera Y, Lyons M, Vione KC, Norton B. Effect of Nature Walks on Depression and Anxiety: A Systematic Review. Sustainability. 2021;13(7):4015. DOI: 10.3390/su13074015

19. Elm Ev, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. BMJ. 2007;335(7624):806-8. DOI: 10.1136/bmj.39335.541782.AD

20. Kotera Y, Van Gordon W. Effects of Self-Compassion Training on Work-Related Well-Being: A Systematic Review. Frontiers in Psychology. 2021;12. DOI: 10.3389/fpsyg.2021.630798

21. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. DOI: 10.1136/bmj.n71

22. Rızalar S, Avcı İ A, Żołądkiewicz P, Altay B, Moraczewska I. University Students' Awareness of Breast and Cervical Cancers: A Comparison of Two Countries and Two Different Cultures. J Breast Health. 2017;13(2):77-82. DOI: 10.5152/tjbh.2017.3117

23. Akhtari-Zavare M, Aliyan-Fini F, Ghanbari-Baghestan A, Mohd-Sidik S. Development and Validation of Breast Cancer Knowledge and Beliefs Questionnaire for Malaysian Student Population. Pertanika Journal of Social Sciences & Humanities. 2018;26(4). Available from: <http://www.pertanika2.upm.edu.my/resources/files/Pertanika%20PAPERS/JSSH%20Vol.%2026%20(4)%20Dec.%202018/23%20JSSH(S)-0899-2018.pdf>

24. Kryvoviaz OV, Shcherba IK, Tomashevska YO, Kudria VV. Students' awareness of breast cancer risk factors (results of a sociological study). Farmatsevtychnyi zhurnal. 2019;0(6):14-21. DOI: 10.32352/10.32352/0367-3057.6.19.02

25. Zuzak TZ, Hałgas M, Kowalska K, Gospodarczyk M, Wdowiak-Filip A, Filip M, et al. Breast cancer–the level of knowledge about epidemiology and prophylaxis among polish medical universities students. EJMT. 2018;1:18. Available from: <http://ww.medical-technologies.eu/upload/6_breast_cancer-_zuziak.pdf>

26. Khraiwesh A, Shakarna A, Solimia S. Knowledge, beliefs and attitudes of female university students in Palestine toward breast cancer and breast self-examination. Hebron University Research Journal-A (Natural Sciences)-(مجلة جامعة الخليل للبحوث-أ (العلوم الطبيعيه. 2020;9(1):3. Available from: <https://digitalcommons.aaru.edu.jo/hujr_a/vol9/iss1/3>

27. Zhang S, Zhu W, Chen B, Tang T, Tao Z, Li X, et al. Relationship between demographic factors, health education, breast cancer-related knowledge, attitudes, and breast self-examination behavior among Chinese female college student: A structural equation analysis. Journal of Obstetrics and Gynaecology Research. 2021;47(12):4440-9. DOI: 10.1111/jog.15064

28. Zhang QN, Lu HX. Knowledge, attitude, practice and factors that influence the awareness of college students with regards to breast cancer. World J Clin Cases. 2022;10(2):538-46. DOI: 10.12998/wjcc.v10.i2.538

29. Onwusah DO, Eboigbe MU, Arute JE, Mgbahurike AA. Knowledge and Awareness of Breast Cancer among University Students In South-South Nigeria. Scholars Academic Journal of Pharmacy. 2017;6(1):4-15. DOI: 10.21276/sajp.2017.6.2

30. Ismail H, Shibani M, Zahrawi HW, Slitin AF, Alzabibi MA, Mohsen F, et al. Knowledge of breast cancer among medical students in Syrian Private University, Syria: a cross-sectional study. BMC Medical Education. 2021;21(1):251. DOI: 10.1186/s12909-021-02673-0

31. Salim KS, Al Attar WM, Jassim RA, Abdullaa NT. Knowledge and awareness about breast cancer among male and female students in Al-Bayan University in Iraq. Annals of Tropical Medicine and Public Health. 2020;23:23-103. DOI: 10.36295/ASRO.2020.23103

32. Faria EH, Kim D, Sisconetto RM, Cucio VFM, Dos Reis Ferreira PPG, Alves BSR, et al. Analysis of Knowledge About Male Breast Cancer Among Higher Education Male Students. Eur J Breast Health. 2021;17(4):333-40. DOI: 10.4274/ejbh.galenos.2021.2021-4-6

33. Saritas S, Aslan Dogan B, Gul E. Knowledge and attitudes of male nursing students towards male breast cancer and breast self-examination: An example from Turkish society. Annals of Medical Research. 2021;27(10):2592-8. DOI: 10.5455/annalsmedres.2020.06.570

34. Ghazi HF, Elnajeh M, Azri A, AbdalQader MA, Baobaid MF, Al-abed A-aAA. Knowledge and beliefs on female breast cancer among male students in a private university, Malaysia. Malaysian Journal of Public Health Medicine. 2017;17(1):8-13. Available from: <https://www.mjphm.org.my/mjphm/index.php?option=com_content&view=article&id=774:knowledge-and-beliefs-on-female-breast-cancer-among-male-students-in-a-private-university-malaysia&catid=113:2017-volume-17-1&Itemid=128>

35. Terui-Kohbata H, Egawa M, Yura K, Yoshida M. Knowledge and attitude of hereditary breast cancer among Japanese university female students. Journal of Human Genetics. 2020;65(7):591-9. DOI: 10.1038/s10038-020-0743-9

36. Xie T, Sun W, Chen D, Liu N, Wang X, Zhang W. Self-efficacy and its influencing factors of breast cancer screening for female college students in China. J Obstet Gynaecol Res. 2019;45(5):1026-34. DOI: 10.1111/jog.13931

37. Raji Lahiji M, Dehdari T, Shokouhi Shoormasti R, Hosseini AF, Navaei M, Zarrati M. Nutrition knowledge, attitudes, and practice towards breast cancer prevention among the female population of Iran University of medical science students. Nutrition and Cancer. 2019;71(8):1355-64. DOI: 10.1080/01635581.2019.1607410

38. Balakrishnan P, Kodamanchili SPDR, Kumar AA, Raju K, Gabunia L. Breast Cancer Awareness among Medical Students in Georgia. International Journal of Progressive Sciences and Technologies. 2022;33(1):58-73. DOI: 10.52155/ijpsat.v33.1.4399

39. Zainul Azlan N, Azhar AA, Abd. Jalil MA. Knowledge Level on Breast Cancer and Breast Self-Examination (BSE) Practice Among Female University Students. INTERNATIONAL JOURNAL OF CARE SCHOLARS. 2022;5(2):46-57. DOI: 10.31436/ijcs.v5i2.249

40. Cichomska J, Sak-Dankosky N, Czarkowska-Pączek B. Knowledge of nursing students about breast cancer prevention. Pielegniarstwo XXI wieku / Nursing in the 21st Century. 2020;19(2):102-9. DOI: 10.2478/pielxxiw-2020-0012

41. Elzahaf R, Mekraz E, Arhaim S, Almansouri M. Knowledge, attitude, and practice regarding breast cancer among female students at college of medical technology/Derna. Libyan Journal of Medical Sciences. 2018;2(4):142-6. DOI: 10.4103/ljms.Ljms\_21\_18

42. Gebresillassie BM, Gebreyohannes EA, Belachew SA, Emiru YK. Evaluation of Knowledge, Perception, and Risk Awareness About Breast Cancer and Its Treatment Outcome Among University of Gondar Students, Northwest Ethiopia. Frontiers in Oncology. 2018;8. DOI: 10.3389/fonc.2018.00501

43. Qasim S, Tayyab H, Zulqadar K, Masood S, Qasim TB, Zubair Z. Breast Cancer knowledge and perceived barriers to help seeking among pre-clinical and clinical female medical students of King Edward Medical University, Lahore: a cross-sectional study. BMC Medical Education. 2020;20(1):222. DOI: 10.1186/s12909-020-02132-2

44. Delgado-Díaz N H-TM, Ramos-Becerra A, Samillán-Jara L, Sánchez-Carranza M, Iglesias-Osores S, Arce-Gil Z. Level of knowledge on risk factors and preventive measures for breast cancer in health science students. Rev Fac Med Hum July. 2020;20(3):412-8. DOI: 10.25176/RFMH.v20i3.2900

45. Yang S, Li P, Yu L, Liu N, Wang J, Guo P, et al. Breast Cancer Awareness Based on Health Information Literacy and Influential Factors among Female Nursing Students in China. Journal of Cancer Education. 2022;37(3):546-54. DOI: 10.1007/s13187-020-01844-9

46. Mahmoud MH, Sayed SH, Ibrahim HA-F, Abd-Elhakam EM. Effect of Health Belief Model-Based Educational Intervention About Breast Cancer on Nursing Students' Knowledge, Health Beliefs and Breast Self-Examination Practice. International Journal of Studies in Nursing. 2018;3(3):77. DOI: 10.20849/ijsn.v3i3.503

47. Rezano A, Utama MS, Wiraswati HL, Ekawardhani S, Adha MJ, Patahuddin NM, et al. Knowledge Level towards Breast Cancer and Breast Self-Examination among Medical Students of Indonesia. Global Medical and Health Communication. 2022;10(1):35-42. DOI: 10.29313/gmhc.v10i1.8942

48. Carlson-Babila S, Bonaventure D, Jules K, Cyril J, Ekabe, Brice V, Naomi L, Abua, et al. Awareness of breast cancer and breast self-examination among female undergraduate students in a higher teachers training college in Cameroon. Pan African Medical Journal. 2017;28. DOI: 10.11604/pamj.2017.28.91.10986

49. Justice MF, King KA, Vidourek RA, Merianos AL. Breast Cancer Knowledge Among College Students: Influencing Factors and Resultant Behaviors. American Journal of Health Education. 2018;49(2):86-93. DOI: 10.1080/19325037.2017.1414645

50. Nimbannavar SM, Mane VP. Breast cancer: knowledge, attitude and practices among undergraduate female students at a government college in Koppal, Karnataka. International Journal of Community Medicine and Public Health. 2019;6(7):2944. DOI: 10.18203/2394-6040.ijcmph20192830

51. Elsayed AA, Mohammed H. Prevention of breast cancer: Effects of early education on knowledge and practice of university students in Saudi Arabia. IOSR JNHS. 2019;8(5):1-9. DOI: 10.9790/1959-0805090109

52. Sarker R, Islam MS, Moonajilin MS, Rahman M, Gesesew HA, Ward PR. Effectiveness of educational intervention on breast cancer knowledge and breast self-examination among female university students in Bangladesh: a pre-post quasi-experimental study. BMC Cancer. 2022;22(1):199. DOI: 10.1186/s12885-022-09311-y

53. Vasishta S, Ramesh S, Babu P S, Ramakrishnegowda AS. Awareness about breast cancer and outcome of teaching on breast self examination in female degree college students. Indian Journal of Medical Specialities. 2018;9(2):56-9. DOI: 10.1016/j.injms.2018.03.002

54. Islam T, Su TT, Musthaffa S, Din NA, Rahman Z, Mohamed KN, et al. Improving Breast Health Literacy Through an Innovative Breast Cancer Awareness Campaign Using the Know Your Lemons (KYL) Materials in Malaysia. Journal of Global Oncology. 2018;4(Supplement 2):36s-s. DOI: 10.1200/jgo.18.59400

55. Linsell L, Forbes LJ, Burgess C, Kapari M, Thurnham A, Ramirez AJ. Validation of a measurement tool to assess awareness of breast cancer. Eur J Cancer. 2010;46(8):1374-81. DOI: 10.1016/j.ejca.2010.02.034

56. Champion VL. Instrument refinement for breast cancer screening behaviors. Nurs Res. 1993;42(3):139-43. DOI: 10.1097/00006199-199305000-00003

57. Youlden DR, Cramb SM, Yip CH, Baade PD. Incidence and mortality of female breast cancer in the Asia-Pacific region. Cancer Biol Med. 2014;11(2):101-15. DOI: 10.7497/j.issn.2095-3941.2014.02.005

58. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394-424. DOI: 10.3322/caac.21492

59. Francies FZ, Hull R, Khanyile R, Dlamini Z. Breast cancer in low-middle income countries: abnormality in splicing and lack of targeted treatment options. Am J Cancer Res. 2020;10(5):1568-91. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7269781/>

60. World Health Organization. Breast cancer 2021. Available from: <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>.

61. Konduri S, Singh M, Bobustuc G, Rovin R, Kassam A. Epidemiology of male breast cancer. Breast. 2020;54:8-14. DOI: 10.1016/j.breast.2020.08.010

62. Hilton BA, Crawford JA, Tarko MA. Men's perspectives on individual and family coping with their wives' breast cancer and chemotherapy. West J Nurs Res. 2000;22(4):438-59. DOI: 10.1177/019394590002200405

63. Harrow A, Wells M, Barbour RS, Cable S. Ambiguity and uncertainty: The ongoing concerns of male partners of women treated for breast cancer. European Journal of Oncology Nursing. 2008;12(4):349-56. DOI: 10.1016/j.ejon.2008.04.009

64. Al-Musa HM, Awadalla NJ, Mahfouz AA. Male Partners' Knowledge, Attitudes, and Perception of Women's Breast Cancer in Abha, Southwestern Saudi Arabia. Int J Environ Res Public Health. 2019;16(17). DOI: 10.3390/ijerph16173089

65. Midding E, Halbach SM, Kowalski C, Weber R, Würstlein R, Ernstmann N. Men With a “Woman’s Disease”: Stigmatization of Male Breast Cancer Patients—A Mixed Methods Analysis. American Journal of Men's Health. 2018;12(6):2194-207. DOI: 10.1177/1557988318799025

66. de Blok CJM, Wiepjes CM, Nota NM, van Engelen K, Adank MA, Dreijerink KMA, et al. Breast cancer risk in transgender people receiving hormone treatment: nationwide cohort study in the Netherlands. BMJ. 2019;365:l1652. DOI: 10.1136/bmj.l1652

67. Amgad M, Shash E, Gaafar R. Cancer education for medical students in developing countries: where do we stand and how to improve? Crit Rev Oncol Hematol. 2012;84(1):122-9. DOI: 10.1016/j.critrevonc.2012.01.003

68. Stubbings S, Robb K, Waller J, Ramirez A, Austoker J, Macleod U, et al. Development of a measurement tool to assess public awareness of cancer. British Journal of Cancer. 2009;101(2):S13-S7. DOI: 10.1038/sj.bjc.6605385

69. Momayyezi M, Fallahzadeh H. Construction and Validation of Breast Cancer Awareness Scale in Iranian Women. J Caring Sci. 2020;9(3):140-7. DOI: 10.34172/jcs.2020.021

70. Al-Khasawneh EM, Leocadio M, Seshan V, Siddiqui ST, Khan AN, Al-Manaseer MM. Transcultural adaptation of the Breast Cancer Awareness Measure. International Nursing Review. 2016;63(3):445-54. DOI: 10.1111/inr.12265

71. Heidari Z, Feizi A. Transcultural adaptation and validation of the Persian version of the breast cancer awareness measure (BCAM) questionnaire. Cancer Medicine. 2018;7(10):5237-51. DOI: 10.1002/cam4.1740

72. Wachira J, Busakhala A, Chite F, Naanyu V, Kisuya J, Otieno G, et al. Refining a questionnaire to assess breast cancer knowledge and barriers to screening in Kenya: Psychometric assessment of the BCAM. BMC Health Services Research. 2017;17(1):110. DOI: 10.1186/s12913-017-2058-x

73. Liu N, Li P, Wang J, Chen D-d, Sun W-j, Guo P-p, et al. Psychometric properties of the Breast Cancer Awareness Measurement among Chinese women: a cross-sectional study. BMJ Open. 2020;10(3):e035911. DOI: 10.1136/bmjopen-2019-035911

74. Moodley J, Scott SE, Mwaka AD, Constant D, Githaiga JN, Stewart TS, et al. Development and validation of the African Women Awareness of CANcer (AWACAN) tool for breast and cervical cancer. PLOS ONE. 2019;14(8):e0220545. DOI: 10.1371/journal.pone.0220545

75. Kotera Y, Ozaki A, Miyatake H, Tsunetoshi C, Nishikawa Y, Kosaka M, et al. Qualitative Investigation into the Mental Health of Healthcare Workers in Japan during the COVID-19 Pandemic. Int J Environ Res Public Health. 2022;19(1). DOI: 10.3390/ijerph19010568

76. Kotera Y, Kaluzeviciute G, Lloyd C, Edwards AM, Ozaki A. Qualitative Investigation into Therapists' Experiences of Online Therapy: Implications for Working Clients. Int J Environ Res Public Health. 2021;18(19). DOI: 10.3390/ijerph181910295

77. Wilkinson L, Gathani T. Understanding breast cancer as a global health concern. Br J Radiol. 2022;95(1130):20211033. DOI: 10.1259/bjr.20211033

Figure 1.

**Identification of studies via databases**

Records removed *before screening*:

Duplicate records removed manually (n = 130)

Records identified from Databases (n = 308):

Embase (n = 60)

MEDLINE (n = 66)

PsycInfo (n = 4)

Google Scholar (n = 178)

**Identification**

Records excluded

(n = 52)

Not relevant by title (n = 38)

Full text unavailable in English (n = 14)

Records screened

(n = 178)

Full text articles excluded

(n = 12)

Not published in peer-reviewed journal (n = 8)

Not specific to university aged students (n = 3)

Published prior 2017 (n = 1)

Published prior to 2017 (n = 1)

Full text articles assessed for eligibility (n = 126)

**Screening**

Studies excluded from review

(n = 81)

Quality assessed as poor and region over-represented (n = 15)

Quality assessed as moderate and region over-represented (n = 29)

Quality assessed as good though based on data from a previous study (n = 1)

Quality assessed as good though less comprehensive than comparable studies in same region (n = 36)

Studies included in quality assessment (n = 114)

Studies included in review

(n = 33)

**Included**

Appendix A

Table 1. Summarised Study Findings of 33 Articles Selected Following Full-Text Screening by Region

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Authors (Year) | Participants | Design | Measures | Outcomes |
| *Eastern Asia* | | | | |
| Zhang et al. (2021) 27 | China: female college students of medical & non-medical courses  (n = 2233)  Avg age: 20.23 ±1.602 years | Descriptive cross-sectional | 3 Non-standardised scales. For all items α = 0.732, KMO (Kaiser–Meyer–Olkin) was 0.785  1. BC knowledge  2. BC attitudes  3. BSE behaviour | BC Awareness/Understanding: BC knowledge influenced by demographic factors and health education.  BSE: Health education had the greatest effect on BSE behaviour, followed by demographic factors, attitudes, and knowledge, and the total effective values were 0.661, 0.27, 0.194, and 0.161, respectively.  14.7% reported having performed BSE, of which 7.4% majored in medicine, and 7.3% majored in non-medicine. |
| Xie et al. (2019) 36 | China: female college students of medical and non-medical courses  (n = 225) | Descriptive cross-sectional | 2 standardised scales  1. BC knowledge measure based upon 2017 American College of Obstetricians and Gynecologists updated Clinical Management Guidelines, α = 0.865  2. The Chinese version of the general self-efficacy scale, internal consistency  coefﬁcient 0.87, α = 0.835 | BC Awareness/Understanding: 48.6% of college students had low awareness of breast cancer and screening.  Breast cancer knowledge level and sleep satisfaction were two predictive factors of general self-efficacy for breast cancer screening. |
| Yang et al. (2022) 45 | China: female nursing students  (n = 205) | Descriptive cross-sectional | 2 standardised scales  1. Chinese version of the Breast Cancer Awareness Measure (C-BCAM), α = 0.90, measuring BC knowledge, attitudes and BSE behaviour  2. Chinese version of the Health Information Literacy Self-rating Scale (HILSS)\* | BC Awareness/Understanding: Health information literacy and breast cancer awareness among female nursing students in Changchun were significantly positively correlated  The nursing students had an average level of health information literacy and a good level of breast cancer awareness |
| Zhang et al. (2022) 28 | China: female college students of medical & non-medical courses  (n = 1346) | Descriptive cross-sectional | 3 Non-standardised scales. For all items content validity 0.780, the total α = 0.702  1. BC knowledge α = 0.533  2. BC attitudes α = 0.697  3. BSE behaviour α = 0.563 | BC Awareness/Understanding: Main factor influencing BC knowledge in female college students in western Yunnan was their grades.  BSE: 56.3%-74.5% of respondents lacked a positive attitude for BSE methods and times, and mammography. |
| Terui-Kohbata et al. (2020) 35 | Japan: female college students of medical & non-medical courses  (n = 353)  Age (range, avg): 20-30, mean 22.2, median 22 years | Descriptive cross-sectional | 2 Non-standardised scales\*  1. Knowledge of hereditary risk only  2. BSE Awareness of / attitude toward self/visual palpation | BC knowledge, awareness, and interest were relatively high.  BC attitudes Family history of BC reduced likelihood to undergo genetic screening.  Positive attitude toward risk-reducing surgery higher for medical majors.  Approximately half of respondents answered that they would hesitate to get married or to have children if they were a *BRCA1/2* mutation carrier. |
| *Africa* | | | | |
| Carlson-Babila et al. (2017) 48 | Cameroon: female students of Higher Teachers Training College  (n = 345)  Age (range, avg): 17 - 34 years (mean = 22.5 ± 3.2). 49.9% 21-25 years | Descriptive cross-sectional | 3 Non-standardised scales\*  1. BC knowledge  2. BC attitudes  3. BSE knowledge | BC Awareness/Understanding: 11.9% reported to have never heard about BC. Television/radio (n 64.5% and health personnel 62.5% were the main sources of knowledge for the 88.1% participants who had heard about BC. 21.4% of participants had sufficient knowledge on BC.  BC attitudes: if diagnosed with BC, 47.7% said they will go to a prayer house, 19.1% will use traditional medicine and only 34.5% will agree to perform mastectomy if necessary  BSE: 47% of those who knew about BC had heard about BSE. 32.9% did not know how often BSE should be performed. 7% participants knew that the appropriate time to perform a BSE was few days after menstruation. 93% recognised the importance of BSE for their health |
| Mahmoud et al. (2018) 46 | Egypt: female nursing students  (n = 104)  Study group  Age (avg): 19.35±1.42 years  Control group  Age (avg): 19.77±1.47 years | Quasi-experimental Intervention  participants divided into a study group (52) and control group (52)  Educational intervention of three 20-30 minutes sessions including lecture, group discussion, brainstorming and demonstration.  BC knowledge, health beliefs and BSE practice assessed at baseline and 2 months post-intervention | 2 Non-standardised scales  1. BC & BSE knowledge α = 0.72  2. BSE observed practice checklist α = 0.78  1 Standardised scale  3. Champion Health Belief Model Scale for BC  α = 0.81 | BC Awareness/Understanding: Significant positive change in mean score of total BC knowledge after educational intervention in the study group than the control group and within the study group before and after educational intervention  BSE: Mean score of BSE practice significantly increased in the study group than control group after educational intervention and within the study group before and after educational intervention |
| Gebresillassie et al. (2018) 42 | Ehiopia: female medical and health science students  (n = 300)  Age (avg): 21.4 SD 2.13 years. 97% 18-25, 3% > 25 | Descriptive cross-sectional | 3 Non-standardised scales\*  1. BC knowledge  2. BC attitudes  3. BSE knowledge | BC Awareness/Understanding: More than two third of the participants acknowledged old age, family history, and smoking as possible risk factors for breast cancer. Majority of the participants were unaware for complex risk factors such as first child after the age of 30 years (51%), early onset of menses (55.3%), and menopause after the age of 55 years (47.7%).  Although the overall level of knowledge on breast cancer was low, high level of knowledge was observed in questions related to general knowledge about BC  BC Attitudes: Majority of study participants had correct beliefs about breast cancer management and its outcomes. however, they had negative perception of breast cancer treatment by considering it to be a long-term and painful process  BSE: 56.0% of participants were aware about once a month recommendations for practicing BSE and 36% for once a year clinical breast examination (CBE) |
| Elzahaf et al. (2018) 41 | Libya: female College of Medical Technology students  (n = 200)  Age (range, avg): 18 to 27, mean 20.8 ± 1.88 years. Nearly 50% of them were aged from 21 to 23, 50% of them were in the first year of their education level | Descriptive cross-sectional | 3 Non-standardised scales\*  1. BC knowledge  2. BC attitudes  3. BSE knowledge | BC Awareness/Understanding: 87.5% reported low knowledge of breast cancer.  BC Attitudes: 90% reported good attitude about BC  BSE: 82.5% had knowledge of BSE as diagnostic for BC. 71.5% had used incorrect practices of breast examination (lack knowledge regarding frequency and appropriate time  to practice BSE) |
| Onwusah et al. (2017) 29 | Nigeria: female (62.3%) male (37.7%) students of 2 universities, 9 faculties, medical and non-medical  (n = 774)  Age (range): 18-36 years | Descriptive cross-sectional  Group comparison (sex, course of study) | 2 Non-standardised scales. For all items total α = 0.72  1. BC knowledge  2. BSE knowledge | BC Awareness/Understanding: All respondents had heard of BC with radio (52.9%) and television (47.3%) respectively as the major sources of information. Level of knowledge and awareness of risk factors for respondents from Delta State University and University of Port Harcourt (51.2%, 49.8%) respectively. For both universities, respondents’ knowledge and awareness of symptoms (75.5%, 72.7% respectively); prevention and treatment (89.2%, 87.8%) respectively  Faculties of Pharmacy for both universities were observed to be more knowledgeable and aware of breast cancer. This is followed by students from Basic Health Sciences/Dentistry  Female students were not significantly more knowledgeable and aware than male students about breast cancer  BSE: For both universities, respondents had excellent knowledge and awareness of BC detection methods (including BSE) (94.0%, 93.5%) |
| *Western Asia* | | | | |
| Salim et al. (2020) 31 | Iraq: 71% female and 29% male university students of medical and non-medical courses  (n = 200)  Age (range, avg): 21.7± 3.22 years | Descriptive cross-sectional  Group comparison (sex) | 2 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge | BC Awareness/Understanding: The level of knowledge and awareness among all the students was 71.7% and only 29% revealed acceptable knowledge and awareness about BC  Knowledge and awareness of risk factors, female 74%, male 26%, some items showed significant difference between male and female  BSE: Knowledge about tools of BC detection showed no significant differences between male and female. 14% of male and 25% of female had correct knowledge about tool of BC early detection, while only 4.5% out of male and 10.5% of female knew the appropriate time to conduct BSE in perimenopause and 5% of male and 13% of female had idea about BSE time after menopause. The total knowledge about BC prevalence and detection of male was 33%, female 67% |
| Khraiwesh et al. (2020) 26 | Palestine: female students of six universities  (n = 1200)  Age (range, avg): 18 to 37 median 20, mean 21±3.3 years | Descriptive cross-sectional | 3 Non-standardised scales. For all items α = 0.85  1. BC knowledge  2. BC attitudes  3. BSE behaviour | BC Awareness/Understanding: 86% had any awareness of the term BC.  Of BC aware participants 27% considered cause of BC to be a medical condition. Other perceived risks for BC were lifestyle factors  BC Attitudes: 60% thought BC is not a punishment from God. 98% of those participants also agreed that breast cancer should receive support from the community.  BSE: Less than half of BC aware participants had ever heard of BSE (33%) or clinical breast examination (29%). Of BSE aware participants, 45% had ever performed BSE themselves. A very high percentage of the participants did not have any knowledge concerning the recommended frequency of BSE (96.5%) or when to perform it in relation to the menstrual cycle (97%) |
| Elsayed et al. (2019) 51 | Saudi Arabia: female university students of non-medical courses  (n = 293)  Age (range): 18+ (62.1% aged 20 to 22 years) | Quasi-experimental design – one group pre-, post-test  Intervention  Lecture on BC and pamphlet  Pre- and post-test dates not reported | 2 Non-standardised scales. For all items α = 0.92  1. BC knowledge  2. BSE knowledge and behaviour | BC Awareness/Understanding: Most of research group had inadequate information on the symptoms of breast cancer, risk factors, preventive measures and early detection methods.  BSE: The health education activity had a significant effect on participants ' awareness of BC and increased BSE experience |
| Ismail et al. (2021) 30 | Syria: 59.5% male, 40.5% female university students of medical courses  (n = 301)  Age not reported | Descriptive cross-sectional | 1 standardised scale.  1. Breast Cancer Awareness Measure (BCAM) | BC Awareness/Understanding: Total mean knowledge regarding BC was above-average (68.4%). Above average level of knowledge for  common symptoms (71.6%) and risk factors (59.5%).  No significant difference in the overall knowledge between males and females. |
| Saritas et al. (2020) 33 | Turkey: male nursing students  (n = 307)  Age (avg): 21.24 ± 2.11 years | Descriptive cross-sectional | 2 Non-standardised scales. For all items α = 0.75  1. BC knowledge  2. BSE knowledge and behaviour | BC Awareness/Understanding: 83.4% aware of BC in males, 72% had previously received information about BC. 23.8% believe they have sufficient knowledge about male BC, 49.5% believe male BC is a disease that can cause death  BSE: 67.8% have already received information about BSE. 83.7% of the students don't practice BSE, 3.3% of those who practice BSE perform once a month and 26.4% of those who don't practice BSE think that BSE is not necessary for the males. 34.5% do not believe BSE to be a time-consuming process. 33.2% believe BSE is a tedious process. 35.8% teach relatives after learning BSE. 30.6% practice regularly after learning BSE. |
| *Western Asia Ex-Soviet* | | | | |
| Balakrishnan et al. (2022) 38 | Georgia: female (n=167), male (n=56) medical university students  (n = 225)  Age not reported  6 academic years in the course, 3 years pre-clinical and 3 years clinical (Pre-clinical, n=118 & clinical, n=107) | Descriptive cross-sectional    Group comparison (education level) | 2 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge (one item) | BC Awareness/Understanding: No significant difference in knowledge between clinical and non-clinical students in identifying correct symptoms and differentiating among wrong symptoms. While differentiating correct and wrong risk factors, clinical students could identify more correct risk factors but both clinical and nonclinical students got confused equally to exclude the wrong ones (p=0.939)  Lack of awareness among the students regarding the gene associated with the worst prognosis  BSE: 44 participants have chosen self-examination to provide a diagnosis of breast cancer with 99% accuracy |
| *Eastern Europe Ex-Soviet* | | | | |
| Kryvoviaz et al. (2019) 24 | Ukraine: female university students of the pharmaceutical department  (n = 240)  Age (range): 36.7% 17–18 years, 43.3% 19–20 years, 20.0% > 21 years | Descriptive cross-sectional | 3 Non-standardised scales\*  developed from National Cancer Institute (USA) guidelines  1. BC knowledge  2. BSE knowledge and behaviour  3. BC Screening Attendance (one item) | BC Awareness/Understanding: 95% aware of the risk for developing BC, higher level of awareness of the fixed risk factors in comparison with the modifiable risk factors  BSE: 83.3% familiar with BSE method, 29.2% perform BSE regularly, 39.1% perform it sometimes, 31.7% do not do it or find it difficult to answer this question  BC Screening Attendance: 46.3% visit gynaecologist regularly |
| Cichomska et al. (2020) 40 | Poland: 95.78% female, 4.22% male nursing students  (n = 166)  Age (range, avg): The mean 22.82 years (SD = 2.75 years). | Descriptive cross-sectional | 2 Non-standardised scales\*  1. BC knowledge  2. BSE behaviour | BC Awareness/Understanding: The respondents gave a total of 67.58% correct answers regarding the knowledge about BC prevention. On average, they obtained 14.87 points (±2.82), which indicated good level of knowledge.  BSE: 96.39% familiar with method of BSE. Of these 41.88% report using this method at least once a month. 36.25% respondents claimed using it less than once a month. 40.15% learned BSE through a brochure or journal article. 13.64% were taught by doctor, 16.67% by nurse. 12.88% learnt about it during their studies. |
| Zuzak et al. (2018) 25 | Poland: 268 female, 49 male medical and non-medical students of medical universities  (n = 317)  Age (range, avg): 20.7 -25.0, 22.8 years | Descriptive cross-sectional  Group comparison (sex, course of study) | 3 Non-standardised scales\*  1. BC knowledge  2. BSE behaviour  3. BC Screening Attendance | BC Awareness/Understanding: Statistically significant differences in medical vs non-medical general BC knowledge and risk factors, greater knowledge in medical students  BSE: 76.21% of female respondents perform BSE at least once a year (males not questioned)  BC Screening Attendance: 69.01% females confirmed first attendance at gynaecologist |
| Rizalar et al. (2017) 22 | Poland and Turkey: female nursing students  Poland (n = 160)  Turkey (n = 190)  Age (avg):  Polish: 19.9 ± 1.6 years  Turkish: 21.36 ± 2.08 years | Descriptive cross-sectional  Group comparison (country / culture) | 3 Non-standardised scales\*  1. BC knowledge  2. BSE attitude and behaviour  3. BC Screening attitudes | BC Awareness/Understanding: Significantly more Turkish students knew risk factors: high-fat diet, being overweight, first childbirth at an advanced age and not having given birth. Significantly more Polish students knew using oral conceptive was a risk factor  BSE: 99.5% Turkish and 98.1% Polish students considered BSE to be required. 97.9% Turkish students knew about, and 72.1% were applying BSE. 84.4% Polish students knew about, and 48.1% were applying BSE. Differences all significant  BC Screening Attitudes: No group difference found between in considering mammography to be required |
| *Northern America* | | | | |
| Justice et al. (2018) 49 | USA: 42.8% male 57.2%  female non-medical university students  (n = 284)  Age not reported | Descriptive cross-sectional  Group comparison (race) | 2 Non-standardised scales  1. BC knowledge  Pearson correlation coefficients > 0.80  2. BSE behaviour (single item summed with other behaviours for total score) Pearson correlation coefficients > 0.80 | BC Awareness/Understanding: Overall mean knowledge score 10.59 (SD = 2.865), based on potential range of 0–20 correct answers. BC knowledge was significantly influenced by race (Whites had a significantly higher mean knowledge score (M = 10.99, SD = 2.594) than non-whites (M = 9.59, SD = 3.182); t (281) = −3.884, P = .000)  BSE: Inverse correlation between BC knowledge and health behaviours. r(237) = −0.172, P = .008 |
| *Southern America* | | | | |
| Faria et al. (2021) 32 | Brazil: male non-medical and health sciences university students  (n = 299)  Age (range, avg): 17-50, median 24 years | Descriptive cross-sectional  Group comparison (course of study) | 2 Non-standardised scales\*  1. BC knowledge (male)  2. BSE knowledge and behaviour (male) | BC Awareness/Understanding: No significant differences in male BC general (30.4% pure science, 37.2% humanities and 41.5% health sciences), heredity and prevention knowledge. 84.9% of health sciences, 79.5% humanities and 55.4% pure sciences students knew BC can be cured. Less than a third of health sciences and humanities students understood that predisposing factors exist; significantly fewer pure sciences students knew of the existence of these factors  BSE: 68.9% said they had no knowledge of how to self-examine, and 76.6% of participants reported not knowing the signs and symptoms of male BC |
| Delgado-Díaz et al. (2020) 44 | Peru: female 72%, male 28%, medical students  (n = 292)  Age (range, avg): 17 – 29, mean 20.5 years | Descriptive cross-sectional | 3 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge  3. BC Screening knowledge | BC Awareness/Understanding: Known risk factors: drinking alcohol 49%, age 46%, early menarche, and late menopause 45%, obesity 44%, smoking 21%, family and personal history 10% and gender 7%  BSE: Known prevention measures: frequency for self-examination 63%, the relationship of menstruation and BSE 54%  BC Screening knowledge: Known prevention measures: correct age for mammography 71%, frequency for mammography 48% |
| *Southern Asia* | | | | |
| Sarker et al. (2022) 52 | Bangladesh: female university students  (n = 400)  Age (range): 18-26 years | Pre-post intervention quasi-experimental  BSE performance demonstrated with images. Pre-intervention and 15 days post-intervention assessments for changes in BC knowledge and BSE practice | 3 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge and behaviour  3. BC Screening knowledge | BC Awareness/Understanding: Significant changes in knowledge and awareness about BC after the educational intervention, measured in the mean scores of symptoms, risk factors, treatment, prevention  BSE: Significant changes were found in BSE practices after the educational intervention.  BC Screening knowledge: Significant changes were found in BC screening knowledge after the educational intervention |
| Lahiji et al. (2019) 37 | Iran: female medical and non-medical students of medical science university  (n = 500)  Age (range, avg): 18 – 40 mean 21.88 ± 2.65 years | Descriptive cross-sectional | 1 Non-standardised scale  1. BC knowledge (nutrition factors) correlation coefficient 0.98, α = 0.89 | BC Awareness/Understanding:  Mean knowledge score 16.96 (range: -0.63-37). 50% did not know “weight gain”, “vitamin D deficiency”, “vitamin C deficiency” and “consuming sweet foods” as BC risk factors. 82.4% and 78% of students cited “smoking” and “alcohol consumption” as BC risk factors respectively. 84% and 83% of students knew that sufficient intake of vegetable and fruit has been associated with a reduced risk of BC, respectively. 23% of participants did not have correct knowledge about a probable association between various cooking method and BC prevention. 28% not aware of adequate fish intake in BC prevention.  70% of students believed that BC can be prevented |
| Qasim et al. (2020) 43 | Pakistan: female clinical and pre-clinical medical students  (n = 266)  Age (range, avg): 18–21 mean 19.3 ± 3.8 years | Descriptive cross-sectional  Group comparison (level of study) | 1 standardised scale\*  1. Breast Cancer Awareness Measure (BCAM) | BC Awareness/Understanding: The difference in the level of perception of two groups was found to be significant for symptoms and risk factors  BSE: 38.7% of the subjects responded that they check their breasts rarely, 33.1% were fairly confident while 8.6% were very confident about detecting a change in their breast, 50.0% never noticed a change in their breast, and 77.4% will contact a doctor within a week or less of finding a change in their breast. Confidence about detecting a change significantly improved after the start of clinical training  No significant differences in the frequency of BSE were found between second and third year students |
| Nimbannavar et al. (2019) 50 | India: female university students  (n = 386)  Age (avg): 19.02 ± 0.84 years | Descriptive cross-sectional | 2 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge and behaviour | BC Awareness/Understanding: 86.11% have heard about BC. Among them, 65.10% know that BC is the most common cancer among women. More than one third of the women who were aware about the disease, believed that smoking and alcohol consumption were major risk factors followed by use of contraceptive pills, genetic factors as well as family history of disease by 26.39%, 26.39% and 24.63% respectively. 65.68% knew that mass/lump in the breast could be a symptom of disease followed by pain in the breast and change in size/shape/colour of breast by 61.58% and 38.70% respectively. 61.58% quoting regular exercise followed by 41.64% quoting diet rich in fiber as protective factors. 70% believed that early detection improves chances of survival and 63.92% believed that BC is curable.  BSE: 80.06% have heard about BSE, 68.03% wanted to practice BSE in future, 12.90% would prefer to consult allopathic system of medicine should they develop any BC symptoms. 5.28% of women in the present study have performed BSE |
| Vasishta et al. (2018) 53 | India: female university students  (n = 177)  Age (range):  18–25 years  (87.5% 18–20 years) | Pre-post intervention quasi-experimental  Teaching program that consisted of power point presentation regarding physiology, risk factors, steps of BSE. Post intervention administration of same questionnaire. | 2 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge and behaviour | BC Awareness/Understanding: After the intervention, there was statistically significant increase in correct answers for anatomy and physiology of breast, transmission of breast cancer, age group affecting breast cancer, approach towards physician  no significant association was found between the demographics and knowledge of the respondents  BSE: 80.8% had never heard/ watched on BSE. 97.7% had never performed BSE. After the intervention, there was statistically significant increase in correct answers for methodology of BSE |
| *South Eastern Asia* | | | | |
| Akhtari-Zavare et al. (2018) 23 | Malaysia: female university students  (n = 792)  Age (avg): 21.77 ± 1.20 | Descriptive cross-sectional scale development  *Data collected 2011* | 2 Standardised scales  1. Novel scale being developed measuring BC knowledge, Kappa for 4 subscales (risk factors, symptoms, BSE, CBE) 0.52-0.90  2. Champion’s Revised Health Belief Model Scale (CHBMS; Champion, 1993) – translated, 6 subscales (susceptibility and seriousness of BC, benefit of BSE, barrier of BSE, confidence of doing BSE, health motivation) α = 0.73-0.83 | All scales demonstrated adequate psychometric quality in this population  BC Knowledge / BSE scores not reported |
| Azlan et al. (2022) 39 | Malaysia: female medical students  (n = 245)  Age (range, avg):  20 years old 36   14.7%  21 years old 56   22.9%  22 years old 44   18.0%  23 years old 61    24.9%  24 years old 29    11.8% | Descriptive cross-sectional | 3 Non-standardised scales\*  1. BC knowledge  2. BSE knowledge  3. BSE behaviour | BC Awareness/Understanding: 98.0% have high  level  of  knowledge  on  risk  factors and   signs   and   symptoms   of   BC. Most of the students (98.4%) have heard about BC  BSE: 93.1% have heard about BSE, 69.0% have performed BSE, 8.6% performed BSE  regularly monthly, reasons for not performing BSE: lack of  knowledge  (35.1%),  forgetfulness  (33.9%) and negligence  (21.6%). 17.6% participants reported of not knowing how  to perform BSE |
| Ghazi et al. (2017) 34 | Malaysia: male medical (26.7%) and non-medical (73.3%) students  (n = 460)  Age (range, avg): 18 – 30, 20.64 ± 2.15 years | Descriptive cross-sectional  Group comparison (course of study, age) | 2 Non-standardised scales\*  1. BC knowledge  2. BC attitudes | BC Awareness/Understanding: Poor knowledge about female BC 54.8%. Good beliefs about female BC 27.4%. Poor beliefs include 44.6% answered that BC is a punishment, 73.3% said it is a fate or destiny and 53.7% wrongly said that breast cancer is contagious.  Medical students showed a higher percentage of good knowledge and there was an association between course of study and level of knowledge. Association between age and beliefs. Medical students showed a higher percentage of good beliefs than non-medical students. |
| Islam et al. (2018) 54 | Malaysia: female (94.2%), male university students  (n = 679)  Age (range): 30 years or below (61%) | One group pretest-postest quasi-experimental  Educational intervention (leaflets, posters, banners) displayed at campus. Discussion on leaflets and Q&A, practical demonstrations of BSE dummy  . | 1 Non-standardised scale\*  1. BC knowledge | The materials improved perceived knowledge on the process of detecting BC (96.5%). 92.8% agreed or strongly agreed that they felt more confident in recognizing the symptoms of BC themselves. There was an increase in self-reported knowledge of BC |
| Rezano et al. (2022) 47 | Indonesia: female (87%), male (13%) medical students  (n = 100)  Age (range, avg): 18–24 years | One group pretest-postest quasi-experimental  Intervention: A mini-lecture on risk factors and early detection | 1 standardised scale\*  1. Breast Cancer Awareness Measure (BCAM) modified and translated | BC Awareness/Understanding: Most respondents believed smoking (97%), genetic inheritance (94%), and a sedentary lifestyle (93%) lead to BC. However, knowledge of important biological risk factors like alcohol consumption (6%), workaholic (6%), age of menstruation (14%), grilled food (13%), married women without children (31%), birth control pill consumption (34%), premature menopause (35%) were low prior dissemination, although they had heard of BC.  BSE: Before dissemination, only 4% knew that BSE prevents BC. 11% said BC could be detected through BSE. Most of the respondents have good knowledge that BSE should be done monthly. However, most of the respondents (92%) think that BSE may change the shape and density of the breast, but after dissemination, they were aware that it is not altered (88%). |

*Note* \* = no scale validity or reliability coefficients reported, BC = Breast Cancer, BSE = Breast Self-Examination, α = Cronbach’s alpha, SD = Standard Deviation

## References

1. Moslemi M, Moradi Y, Dehghanbanadaki H, Afkhami H, Khaledi M, Sedighimehr N, et al. The association between ATM variants and risk of breast cancer: a systematic review and meta-analysis. BMC Cancer. 2021;21(1):27. DOI: 10.1186/s12885-020-07749-6

2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3):209-49. DOI: 10.3322/caac.21660

3. Benson JR, Jatoi I. The global breast cancer burden. Future Oncol. 2012;8(6):697-702. DOI: 10.2217/fon.12.61

4. Organization WH. The Global Breast Cancer Initiative (GBCI): World Health Organization; 2022 [Available from: <https://www.who.int/publications/m/item/the-global-breast-cancer-initiative-gbci>.

5. Ginsburg O, Rositch AF, Conteh L, Mutebi M, Paskett ED, Subramanian S. Breast Cancer Disparities Among Women in Low- and Middle-Income Countries. Current Breast Cancer Reports. 2018;10(3):179-86. DOI: 10.1007/s12609-018-0286-7

6. Hackshaw AK, Paul EA. Breast self-examination and death from breast cancer: a meta-analysis. Br J Cancer. 2003;88(7):1047-53. DOI: 10.1038/sj.bjc.6600847

7. Weiss NS. Breast Cancer Mortality in Relation to Clinical Breast Examination and Breast Self-Examination. The Breast Journal. 2003;9(s2):S86-S9. DOI: 10.1046/j.1524-4741.9.s2.9.x

8. Albeshan SM, Hossain SZ, Mackey MG, Brennan PC. Can Breast Self-examination and Clinical Breast Examination Along With Increasing Breast Awareness Facilitate Earlier Detection of Breast Cancer in Populations With Advanced Stages at Diagnosis? Clinical Breast Cancer. 2020;20(3):194-200. DOI: 10.1016/j.clbc.2020.02.001

9. Wang Y-J, Wang F, Yu L-X, Xiang Y-J, Zhou F, Huang S-Y, et al. Worldwide review with meta-analysis of women’s awareness about breast cancer. Patient Education and Counseling. 2022;105(7):1818-27. DOI: 10.1016/j.pec.2021.12.012

10. Hosseini MS, Arab M, Nemati Honar B, Noghabaei G, Safaei N, Ghasemi T, et al. Age - specific incidence rate change at breast Cancer and its different histopathologic subtypes in Iran and Western countries. Pak J Med Sci. 2013;29(6):1354-7. DOI: Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3905388/>

11. Anastasi N, Lusher J. The impact of breast cancer awareness interventions on breast screening uptake among women in the United Kingdom: A systematic review. Journal of Health Psychology. 2019;24(1):113-24. DOI: 10.1177/1359105317697812

12. Britt KL, Cuzick J, Phillips K-A. Key steps for effective breast cancer prevention. Nature Reviews Cancer. 2020;20(8):417-36. DOI: 10.1038/s41568-020-0266-x

13. Naja F, Nasreddine L, Awada S, El Sayed Ahmad R, Hwalla N. Nutrition in the Prevention of Breast Cancer: A Middle Eastern Perspective. Frontiers in Public Health. 2019;7. DOI: 10.3389/fpubh.2019.00316

14. Peacey V, Steptoe A, Davídsdóttir S, Baban A, Wardle J. Low levels of breast cancer risk awareness in young women: An international survey. European Journal of Cancer. 2006;42(15):2585-9. DOI: 10.1016/j.ejca.2006.03.017

15. Peltzer K, Pengpid S. Awareness of breast cancer risk among female university students from 24 low, middle income and emerging economy countries. Asian Pac J Cancer Prev. 2014;15(18):7875-8. DOI: 10.7314/apjcp.2014.15.18.7875

16. Almutairi AH, Tamrin SBBM, Wirza R, Ahmad NB. Systematic Review on Knowledge and Awareness of Breast Cancer and Risk Factors Among Young Women. Advances in Bioscience and Clinical Medicine. 2019;7(1):7. DOI: 10.7575/aiac.abcmed.v.7n.1p.41

17. Garritty C, Gartlehner G, Nussbaumer-Streit B, King VJ, Hamel C, Kamel C, et al. Cochrane Rapid Reviews Methods Group offers evidence-informed guidance to conduct rapid reviews. J Clin Epidemiol. 2021;130:13-22. DOI: 10.1016/j.jclinepi.2020.10.007

18. Kotera Y, Lyons M, Vione KC, Norton B. Effect of Nature Walks on Depression and Anxiety: A Systematic Review. Sustainability. 2021;13(7):4015. DOI: 10.3390/su13074015

19. Elm Ev, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. BMJ. 2007;335(7624):806-8. DOI: 10.1136/bmj.39335.541782.AD

20. Kotera Y, Van Gordon W. Effects of Self-Compassion Training on Work-Related Well-Being: A Systematic Review. Frontiers in Psychology. 2021;12. DOI: 10.3389/fpsyg.2021.630798

21. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. DOI: 10.1136/bmj.n71

22. Rızalar S, Avcı İ A, Żołądkiewicz P, Altay B, Moraczewska I. University Students' Awareness of Breast and Cervical Cancers: A Comparison of Two Countries and Two Different Cultures. J Breast Health. 2017;13(2):77-82. DOI: 10.5152/tjbh.2017.3117

23. Akhtari-Zavare M, Aliyan-Fini F, Ghanbari-Baghestan A, Mohd-Sidik S. Development and Validation of Breast Cancer Knowledge and Beliefs Questionnaire for Malaysian Student Population. Pertanika Journal of Social Sciences & Humanities. 2018;26(4).

24. Kryvoviaz OV, Shcherba IK, Tomashevska YO, Kudria VV. Students' awareness of breast cancer risk factors (results of a sociological study). Farmatsevtychnyi zhurnal. 2019;0(6):14-21. DOI: 10.32352/10.32352/0367-3057.6.19.02

25. Zuzak TZ, Hałgas M, Kowalska K, Gospodarczyk M, Wdowiak-Filip A, Filip M, et al. Breast cancer–the level of knowledge about epidemiology and prophylaxis among polish medical universities students. EJMT. 2018;1:18. DOI: Available from: <http://ww.medical-technologies.eu/upload/6_breast_cancer-_zuziak.pdf>

26. Khraiwesh A, Shakarna A, Solimia S. Knowledge, beliefs and attitudes of female university students in Palestine toward breast cancer and breast self-examination. Hebron University Research Journal-A (Natural Sciences)-(مجلة جامعة الخليل للبحوث-أ (العلوم الطبيعيه. 2020;9(1):3. DOI: Available at: <https://digitalcommons.aaru.edu.jo/hujr_a/vol9/iss1/3>

27. Zhang S, Zhu W, Chen B, Tang T, Tao Z, Li X, et al. Relationship between demographic factors, health education, breast cancer-related knowledge, attitudes, and breast self-examination behavior among Chinese female college student: A structural equation analysis. Journal of Obstetrics and Gynaecology Research. 2021;47(12):4440-9. DOI: 10.1111/jog.15064

28. Zhang QN, Lu HX. Knowledge, attitude, practice and factors that influence the awareness of college students with regards to breast cancer. World J Clin Cases. 2022;10(2):538-46. DOI: 10.12998/wjcc.v10.i2.538

29. Onwusah DO, Eboigbe MU, Arute JE, Mgbahurike AA. Knowledge and Awareness of Breast Cancer among University Students In South-South Nigeria. Scholars Academic Journal of Pharmacy. 2017;6(1):4-15. DOI: 10.21276/sajp.2017.6.2

30. Ismail H, Shibani M, Zahrawi HW, Slitin AF, Alzabibi MA, Mohsen F, et al. Knowledge of breast cancer among medical students in Syrian Private University, Syria: a cross-sectional study. BMC Medical Education. 2021;21(1):251. DOI: 10.1186/s12909-021-02673-0

31. Salim KS, Al Attar WM, Jassim RA, Abdullaa NT. Knowledge and awareness about breast cancer among male and female students in Al-Bayan University in Iraq. Annals of Tropical Medicine and Public Health. 2020;23:23-103. DOI: <http://doi.org/10.36295/ASRO.2020.23103>

32. Faria EH, Kim D, Sisconetto RM, Cucio VFM, Dos Reis Ferreira PPG, Alves BSR, et al. Analysis of Knowledge About Male Breast Cancer Among Higher Education Male Students. Eur J Breast Health. 2021;17(4):333-40. DOI: 10.4274/ejbh.galenos.2021.2021-4-6

33. Saritas S, Aslan Dogan B, Gul E. Knowledge and attitudes of male nursing students towards male breast cancer and breast self-examination: An example from Turkish society. Annals of Medical Research. 2021;27(10):2592-8. DOI: 10.5455/annalsmedres.2020.06.570

34. Ghazi HF, Elnajeh M, Azri A, AbdalQader MA, Baobaid MF, Al-abed A-aAA. Knowledge and beliefs on female breast cancer among male students in a private university, Malaysia. Malaysian Journal of Public Health Medicine. 2017;17(1):8-13.

35. Terui-Kohbata H, Egawa M, Yura K, Yoshida M. Knowledge and attitude of hereditary breast cancer among Japanese university female students. Journal of Human Genetics. 2020;65(7):591-9. DOI: 10.1038/s10038-020-0743-9

36. Xie T, Sun W, Chen D, Liu N, Wang X, Zhang W. Self-efficacy and its influencing factors of breast cancer screening for female college students in China. J Obstet Gynaecol Res. 2019;45(5):1026-34. DOI: 10.1111/jog.13931

37. Raji Lahiji M, Dehdari T, Shokouhi Shoormasti R, Hosseini AF, Navaei M, Zarrati M. Nutrition knowledge, attitudes, and practice towards breast cancer prevention among the female population of Iran University of medical science students. Nutrition and Cancer. 2019;71(8):1355-64. DOI: 10.1080/01635581.2019.1607410

38. Balakrishnan P, Kodamanchili SPDR, Kumar AA, Raju K, Gabunia L. Breast Cancer Awareness among Medical Students in Georgia. International Journal of Progressive Sciences and Technologies. 2022;33(1):58-73. DOI: 10.52155/ijpsat.v33.1.4399

39. Zainul Azlan N, Azhar AA, Abd. Jalil MA. Knowledge Level on Breast Cancer and Breast Self-Examination (BSE) Practice Among Female University Students. INTERNATIONAL JOURNAL OF CARE SCHOLARS. 2022;5(2):46-57. DOI: 10.31436/ijcs.v5i2.249

40. Cichomska J, Sak-Dankosky N, Czarkowska-Pączek B. Knowledge of nursing students about breast cancer prevention. Pielegniarstwo XXI wieku / Nursing in the 21st Century. 2020;19(2):102-9. DOI: 10.2478/pielxxiw-2020-0012

41. Elzahaf R, Mekraz E, Arhaim S, Almansouri M. Knowledge, attitude, and practice regarding breast cancer among female students at college of medical technology/Derna. Libyan Journal of Medical Sciences. 2018;2(4):142-6. DOI: 10.4103/ljms.Ljms\_21\_18

42. Gebresillassie BM, Gebreyohannes EA, Belachew SA, Emiru YK. Evaluation of Knowledge, Perception, and Risk Awareness About Breast Cancer and Its Treatment Outcome Among University of Gondar Students, Northwest Ethiopia. Frontiers in Oncology. 2018;8. DOI: 10.3389/fonc.2018.00501

43. Qasim S, Tayyab H, Zulqadar K, Masood S, Qasim TB, Zubair Z. Breast Cancer knowledge and perceived barriers to help seeking among pre-clinical and clinical female medical students of King Edward Medical University, Lahore: a cross-sectional study. BMC Medical Education. 2020;20(1):222. DOI: 10.1186/s12909-020-02132-2

44. Delgado-Díaz N H-TM, Ramos-Becerra A, Samillán-Jara L, Sánchez-Carranza M, Iglesias-Osores S, Arce-Gil Z. Level of knowledge on risk factors and preventive measures for breast cancer in health science students. Rev Fac Med Hum July. 2020;20(3):412-8.

45. Yang S, Li P, Yu L, Liu N, Wang J, Guo P, et al. Breast Cancer Awareness Based on Health Information Literacy and Influential Factors among Female Nursing Students in China. Journal of Cancer Education. 2022;37(3):546-54. DOI: 10.1007/s13187-020-01844-9

46. Mahmoud MH, Sayed SH, Ibrahim HA-F, Abd-Elhakam EM. Effect of Health Belief Model-Based Educational Intervention About Breast Cancer on Nursing Students' Knowledge, Health Beliefs and Breast Self-Examination Practice. International Journal of Studies in Nursing. 2018;3(3):77. DOI: 10.20849/ijsn.v3i3.503

47. Rezano A, Utama MS, Wiraswati HL, Ekawardhani S, Adha MJ, Patahuddin NM, et al. Knowledge Level towards Breast Cancer and Breast Self-Examination among Medical Students of Indonesia. Global Medical and Health Communication. 2022;10(1):35-42.

48. Carlson-Babila S, Bonaventure D, Jules K, Cyril J, Ekabe, Brice V, Naomi L, Abua, et al. Awareness of breast cancer and breast self-examination among female undergraduate students in a higher teachers training college in Cameroon. Pan African Medical Journal. 2017;28. DOI: 10.11604/pamj.2017.28.91.10986

49. Justice MF, King KA, Vidourek RA, Merianos AL. Breast Cancer Knowledge Among College Students: Influencing Factors and Resultant Behaviors. American Journal of Health Education. 2018;49(2):86-93. DOI: 10.1080/19325037.2017.1414645

50. Nimbannavar SM, Mane VP. Breast cancer: knowledge, attitude and practices among undergraduate female students at a government college in Koppal, Karnataka. International Journal of Community Medicine and Public Health. 2019;6(7):2944. DOI: <https://dx.doi.org/10.18203/2394-6040.ijcmph20192830>

51. Elsayed AA, Mohammed H. Prevention of breast cancer: Effects of early education on knowledge and practice of university students in Saudi Arabia. IOSR JNHS. 2019;8(5):1-9. DOI: <https://doi.org/10.9790/1959-0805090109>

52. Sarker R, Islam MS, Moonajilin MS, Rahman M, Gesesew HA, Ward PR. Effectiveness of educational intervention on breast cancer knowledge and breast self-examination among female university students in Bangladesh: a pre-post quasi-experimental study. BMC Cancer. 2022;22(1):199. DOI: 10.1186/s12885-022-09311-y

53. Vasishta S, Ramesh S, Babu P S, Ramakrishnegowda AS. Awareness about breast cancer and outcome of teaching on breast self examination in female degree college students. Indian Journal of Medical Specialities. 2018;9(2):56-9. DOI: 10.1016/j.injms.2018.03.002

54. Islam T, Su TT, Musthaffa S, Din NA, Rahman Z, Mohamed KN, et al. Improving Breast Health Literacy Through an Innovative Breast Cancer Awareness Campaign Using the Know Your Lemons (KYL) Materials in Malaysia. Journal of Global Oncology. 2018;4(Supplement 2):36s-s. DOI: 10.1200/jgo.18.59400

55. Linsell L, Forbes LJ, Burgess C, Kapari M, Thurnham A, Ramirez AJ. Validation of a measurement tool to assess awareness of breast cancer. Eur J Cancer. 2010;46(8):1374-81. DOI: 10.1016/j.ejca.2010.02.034

56. Champion VL. Instrument refinement for breast cancer screening behaviors. Nurs Res. 1993;42(3):139-43. DOI: 10.1097/00006199-199305000-00003

57. Youlden DR, Cramb SM, Yip CH, Baade PD. Incidence and mortality of female breast cancer in the Asia-Pacific region. Cancer Biol Med. 2014;11(2):101-15. DOI: 10.7497/j.issn.2095-3941.2014.02.005

58. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394-424. DOI: 10.3322/caac.21492

59. Francies FZ, Hull R, Khanyile R, Dlamini Z. Breast cancer in low-middle income countries: abnormality in splicing and lack of targeted treatment options. Am J Cancer Res. 2020;10(5):1568-91. DOI: Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7269781/>

60. Organization WH. Breast cancer 2021 [Available from: <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>.

61. Konduri S, Singh M, Bobustuc G, Rovin R, Kassam A. Epidemiology of male breast cancer. Breast. 2020;54:8-14. DOI: 10.1016/j.breast.2020.08.010

62. Hilton BA, Crawford JA, Tarko MA. Men's perspectives on individual and family coping with their wives' breast cancer and chemotherapy. West J Nurs Res. 2000;22(4):438-59. DOI: 10.1177/019394590002200405

63. Harrow A, Wells M, Barbour RS, Cable S. Ambiguity and uncertainty: The ongoing concerns of male partners of women treated for breast cancer. European Journal of Oncology Nursing. 2008;12(4):349-56. DOI: 10.1016/j.ejon.2008.04.009

64. Al-Musa HM, Awadalla NJ, Mahfouz AA. Male Partners' Knowledge, Attitudes, and Perception of Women's Breast Cancer in Abha, Southwestern Saudi Arabia. Int J Environ Res Public Health. 2019;16(17). DOI: 10.3390/ijerph16173089

65. Midding E, Halbach SM, Kowalski C, Weber R, Würstlein R, Ernstmann N. Men With a “Woman’s Disease”: Stigmatization of Male Breast Cancer Patients—A Mixed Methods Analysis. American Journal of Men's Health. 2018;12(6):2194-207. DOI: 10.1177/1557988318799025

66. de Blok CJM, Wiepjes CM, Nota NM, van Engelen K, Adank MA, Dreijerink KMA, et al. Breast cancer risk in transgender people receiving hormone treatment: nationwide cohort study in the Netherlands. BMJ. 2019;365:l1652. DOI: 10.1136/bmj.l1652

67. Amgad M, Shash E, Gaafar R. Cancer education for medical students in developing countries: where do we stand and how to improve? Crit Rev Oncol Hematol. 2012;84(1):122-9. DOI: 10.1016/j.critrevonc.2012.01.003

68. Stubbings S, Robb K, Waller J, Ramirez A, Austoker J, Macleod U, et al. Development of a measurement tool to assess public awareness of cancer. British Journal of Cancer. 2009;101(2):S13-S7. DOI: 10.1038/sj.bjc.6605385

69. Momayyezi M, Fallahzadeh H. Construction and Validation of Breast Cancer Awareness Scale in Iranian Women. J Caring Sci. 2020;9(3):140-7. DOI: 10.34172/jcs.2020.021

70. Al-Khasawneh EM, Leocadio M, Seshan V, Siddiqui ST, Khan AN, Al-Manaseer MM. Transcultural adaptation of the Breast Cancer Awareness Measure. International Nursing Review. 2016;63(3):445-54. DOI: 10.1111/inr.12265

71. Heidari Z, Feizi A. Transcultural adaptation and validation of the Persian version of the breast cancer awareness measure (BCAM) questionnaire. Cancer Medicine. 2018;7(10):5237-51. DOI: 10.1002/cam4.1740

72. Wachira J, Busakhala A, Chite F, Naanyu V, Kisuya J, Otieno G, et al. Refining a questionnaire to assess breast cancer knowledge and barriers to screening in Kenya: Psychometric assessment of the BCAM. BMC Health Services Research. 2017;17(1):110. DOI: 10.1186/s12913-017-2058-x

73. Liu N, Li P, Wang J, Chen D-d, Sun W-j, Guo P-p, et al. Psychometric properties of the Breast Cancer Awareness Measurement among Chinese women: a cross-sectional study. BMJ Open. 2020;10(3):e035911. DOI: 10.1136/bmjopen-2019-035911

74. Moodley J, Scott SE, Mwaka AD, Constant D, Githaiga JN, Stewart TS, et al. Development and validation of the African Women Awareness of CANcer (AWACAN) tool for breast and cervical cancer. PLOS ONE. 2019;14(8):e0220545. DOI: 10.1371/journal.pone.0220545

75. Kotera Y, Ozaki A, Miyatake H, Tsunetoshi C, Nishikawa Y, Kosaka M, et al. Qualitative Investigation into the Mental Health of Healthcare Workers in Japan during the COVID-19 Pandemic. Int J Environ Res Public Health. 2022;19(1). DOI: 10.3390/ijerph19010568

76. Kotera Y, Kaluzeviciute G, Lloyd C, Edwards AM, Ozaki A. Qualitative Investigation into Therapists' Experiences of Online Therapy: Implications for Working Clients. Int J Environ Res Public Health. 2021;18(19). DOI: 10.3390/ijerph181910295

77. Wilkinson L, Gathani T. Understanding breast cancer as a global health concern. Br J Radiol. 2022;95(1130):20211033. DOI: 10.1259/bjr.20211033