Research article

Awareness, attitudes and practices of women in relation to breast cancer in Niger

Aissami Abdou a,*, Guido Van Hal a, Issimouha Dille b

a Department of Epidemiology and Social Medicine, University of Antwerp, Belgium
b Surgical Oncology, Niamey National Reference Hospital, Niamey, Niger

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ABSTRACT

Introduction: In Niger, breast cancer is the first cancer related morbidity and mortality within female population. While awareness can contribute to early diagnosis and disease mortality reduction, Niger women's knowledge of breast cancer is not well documented. In this study, we assessed the awareness, attitudes and practices of women in relation to breast cancer and identify the factors associated with it.

Methods: The study was conducted through a cross sectional survey in Zinder and Niamey regions. A random sampling was used to select women in households within health districts. We defined a breast cancer knowledge score and used a generalized linear model to assess factors associated with it.

Results: Overall women's knowledge of breast cancer was found to be low, only 41.2% (37.5–45.0) were aware of breast cancer. 65.0% (61.3–68.7) of women demonstrated an awareness of symptoms. Insufficient level of knowledge was observed on knowledge of risk and protection factors with 27.4% (24.0–31.0), breast cancer good practice with 16.9% (14.2–19.7), not having a history of participation in breast cancer screening and living in rural and peri-urban areas were found to be associated with awareness of breast cancer.

Conclusion: Niger women were found to have a relatively low level of breast cancer awareness. While not acquainted with self and clinical breast examination, Niger women knowledge of breast cancer symptoms was acceptable. Awareness programs can promote clinical breast examination as mammography is not common and promote early detection procedures.

1. Introduction

Breast cancer (BC) is a worldwide public health concern. It remains the leading cancer morbidity and mortality within female population with outstanding geographical variations. According to the World Health Organization, (WHO) latest fact sheets (Globocan, 2018), North American, European and high-income Asian/Oceanian countries have the highest BC figures, confirming higher incidence in the more-developed regions of the world. In fact, BC incidence and mortality (Age-Standardized Rates per 100,000 females) are highest in Australia/New Zealand with 94.2 incidence and 12.6 mortality. Western Europe (Belgium, the Netherlands, and France) accounts for 92.6 and 15.5 incidence and mortality respectively. Northern European countries (Sweden, Finland, United Kingdom, Denmark) have 90.1 incidence and 14.1 mortality. Northern America countries stands for 84.8 and 12.6. respectively. Estimates reached 56.8 and 13.4 in South American countries. Western Asia has 45.3 incidence and 13.6 mortality.

BC is the most frequently diagnosed cancer in women living in Gulf Cooperation Council countries (GCCCs). In the six GCCCs (Bahrain, Saudi Arabia, Kuwait, Oman, Qatar and the United Arab Emirates), BC is the greatest cause of cancer incidence and mortality (Tanner and Cheung, 2020). In the African region, Northern Africa has the higher estimates with 48.9 incidence and 18.4 mortality. Western Africa has 37.3 and 17.8 incidence and mortality respectively. Lowest figures were observed in the middle Africa (27.9 and 15.8) and south-central Asia (25.9 and 13.6) regions (Bray et al., 2018). It has been documented that BC prevalence and mortality are increasing in sub-Saharan African countries (Foulden et al., 2012; Samuel et al., 2017). (Adeloye et al., 2018) stated that the overall pooled African crude incidence of BC from population-based registries was 24.5 per 100, 000. Some neighboring countries of Niger such as Nigeria, Algeria and Burkina have archived BC burden.
nevertheless epidemiological BC literature is not extensive in Niger itself. Burkina Faso has 12.3 and 9.1 age standardized incidence and mortality rates while Algeria has 22.3 and 11.4. In Nigeria, according to the latest WHO data Breast Cancer Deaths reached 14,932 with an age adjusted Death Rate of 30.08 per 100,000 of population.

Breast cancer remains a public health concern worldwide including sub-Saharan African countries (Brinton et al., 2014; Ferlay et al., 2010). In Niger, breast cancer is identified as the first cause of cancer related morbidity and mortality standing for twenty-eight percent (27.7%) of the overall cancer mortality within the female population (WHO Cancer Country Profiles, 2014; Zaki et al., 2013; Mamoudou et al., 2013). Studies found that if women adopt early risk-reduction behaviours like physical activity, healthy diets, breastfeeding, non-extensive alcoholic beverage consumption to mention but a few, a part of the breast cancer burden can be prevented through primary prevention (Golditz and Bohlke, 2014; Graham and Kari, 2015). This is even more important in countries like Niger where mammographic screening facilities are not widely available and research literature on breast cancer epidemiology and awareness is not extensive. Soliman et al. 2015 outlined younger age and late diagnosis are common features of breast cancer in Niger.

Knowledge of breast cancer among women is not generally high in sub-Saharan Africa and not very well documented in Niger (Githaiga et al., 2017). Breast cancer awareness can significantly contribute to early diagnosis and disease mortality reduction (Anderson & Jakesz 2008).

According to the latest 2012 Niger population Census (Décret N° 2011-059/PCSRD/ME/F DU 27 Janvier, 2011), the country population is 17,138,707 inhabitants with 8,518,818 men (49.7%) and 8,619,889 women (50.3 %). The current population of Niger is 24,088,564, based on projections of the latest United Nations data (https://worldpopulationreview.com/countries/niger-population/). Niger is also the largest country in West Africa. The 2020 population grew 3.84% over the 2019 population, adding about 896,000 people to the population. 69% of Niger population is rural while 31% is urban. Age groups of 0–4 years (21.6%), 5–9 years (17.5%) and 10–14 years (12.6%) have the highest proportions in Niger population age structure. Citizens aged from 15 years old have a cumulative proportion of 48.3%. People aged from 65 years old and above represent 3.1% of the population. Thus, Niger population is very young. Niger has one of the lowest literacy rates in the world. The preschool enrolment rate is just 7% and over 50% of children aged 7–16 are not in school. Literacy rate for 15 years and older is 39% for men and 22.5% for women, Gross graduation ratio (ISCED 6 and 7, First degrees) is 5.5% for men and 3.3% for women. (UNICEF, https://www.unicef.org/niger/education) and UNESCO (http://uis.unesco.org/en/country/ne).

To the best of our knowledge, no recent studies were conducted in the analysis of knowledge, attitudes and practices of women in relation to breast cancer in Niger. The country does not yet have an operational cancer policy/strategy/action plan (WHO, Cancer Country Profiles, 2014). In this paper, we used and adapted Breast Cancer Awareness Measure, (BCAM) to assess knowledge, practices and attitudes of women in Niamey and Zinder.

2. Methods

2.1. Study design, sampling and data collection

This study was conducted in Niamey and Zinder regions of Niger. Niamey is the capital city of the country, located in the south west, and hosting the national reference hospital, where the majority of cancer cases are diagnosed and treated. Zinder is the most populated region of the country (3,539,764 inhabitants (20.7 %), it lies at the crossroads of the main east-west road and the north-south route from the desert to Nigeria. The region is also hosting a second national reference hospital.

The study targeted women aged from 25 and above to participate to the survey. The lower limit age of 25 was set because the incidence of BC below that age is documented to be extremely low. In fact, this is the category of women that would be more likely to be concerned with breast cancer as compared to more younger women. Niger women average age is 20 years, the population is young with proportion of people less than 15 years old reaching 51.7% and women being 50.3 % of the overall population (National Census data, RGPN, 2012 INS). The sampling frame was composed by a list of villages from the health districts and the number of households in the two regions with population of women 25 years and older. A two-stage clustered random sampling was used to select women participating to the study. Commune in Niger administrative division refers to a municipality, it’s a settlement either urban or rural, it’s composed of quarters/wards and small townships. A group of ‘communes’, form a department and group of departments form a region. The country now has 10 regions, 36 departments and 265 communes. Firstly, villages/quarters were randomly selected within the village using random walk technique. The interviewer started from the house of the head of village (usually centre of the village (for rural area) or the quarter (for urban area), threw a pen in the air and started the selection of the households from the direction indicated by the pen. The first house was selected and women within the household were asked to participate to the survey, this was done until the end of the street. Finally, women were randomly selected within these households as primary sampling units. The required sample size was calculated based on a 95% confidence interval, assuming that 50% of women know the basics of BC with a correction of design effect for cluster. We assumed an average number of 7 persons per household (National Institute of Statistics reference from the last 2012 population census). The collected data was analysed using R version 3.4.0 Epidata analysis v2.2.2.183 and IBM SPSS Statistics 24. All confidence intervals were computed with 5% error margin. The questionnaires were conducted using face to face interviews. The questionnaire was orally administered using Hausa (Maradi) and Djerma (Niamey) languages. The original questionnaire in English was translated by certified language translation and data collection institute (http://www.rem-africa.com/) prior to data collection. Data collectors speak both Hausa and Djerma, it should be noted that majority of women in Niger Speak Hausa. Two teams (one for each region) of two data collectors were used for this survey, moreover each team had a supervisor. The teams used 4*4 cars for field works and were paid at local rate as daily workers. A two-day training was organised in ReM-Africa cabinet in Niamey to familiarize the team with the survey protocol. The first author supervised the data collectors to ensure the compliance with the survey protocol.

The study was approved by directorate of research and studies board, (Direction des etudes et Recherche), DER, Niger republic ministry health, by authorization letter (04712/MSP/SG/DEP/DER on 21-12-2017). Informed consent was obtained for each respondent participating in the study.

The aim of the study was to assess women’s knowledge, attitudes and practices related to BC and identify the factors associated with this knowledge.

2.2. Knowledge score construction

We constructed a knowledge score variable for each respondent woman to assess an overall answer and estimate her level of knowledge and breast cancer awareness. This was done using the WHO breast cancer rating scale (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC C1514477/). We selected main factors associated with breast cancer like family history, maternity, breastfeeding and age. A scan of risk factors. protective factors, symptoms and warning signs was conducted to complete the BCAM items on symptoms and risk/protective factors. A 5-point Likert scale was used for assessing knowledge of women related to BC.

A Weighting of the knowledge factors was done to substantiate and allow some leverage for important risk factors generally accepted (WHO) but also accounting for context specific factors. Globally, correct answers
were given points (see Table 1 below) and a wrong answer was given zero. Mammography is not that much common in Niger context (as of January 2018, the data collection period, only one mammography machine was available for the whole country and it was located in Niamey). It is accessible only to few high income women or women referred under specific conditions. In Niger, screening is often done using clinical breast examination. Hormone replacement therapy is also not common. As showed in the descriptive results, only 0.4% (0.2–1.3) of Niger Women smoke and 0.7% (0.3–1.7) of them drink alcohol, so even if these are known established risk factors, they do not seem to be very relevant in Niger context, so we did not weigh them. Breastfeeding, maternity, physical activity, breast self-examination, clinical breast examination and age-related factors were weighted to account for their relative importance. Some important potential BC symptoms were also weighted.

In general, women should have minimum half of the overall knowledge score (18 total points) to be labelled as aware of breast cancer.

In this study, “higher education” refers to educational level above secondary school. By “rural”, we mean areas (township, quarters, communes) that are officially declared rural by administrative authorities, would this be next to urban areas, as this is the case in Niamey. “Breastfeeding attitude” refers to women that use to breastfeed their children months after birthhood.

2.3. Generalized Linear Model

A Generalized Linear Model was built where knowledge score was used as a response variable to assess its relationship with other predictors related to socio demographic, practice and attitude features. The response variable, knowledge score, was used to classify women based on their answers into those aware of breast cancer (was coded as response variable = 1) and those not aware (was coded as response variable = 0). A generalized linear model through Ordinary Logistic Regression, OLR (ignoring clustering) and through Generalized Estimating Equations (GEE) (Molenberghs and Verbeke, 2005), accounting for clustering at health centre levels were used to model the odds of being aware of BC accounting for predictors.

3. Results

3.1. Description of the sample

The questionnaire was basically administered to 675 women in the two regions historically hosting national reference hospitals, Niamey and Zinder. Niamey is the capital city and Zinder the most populated region in Niger. Households were selected within health districts in ‘commune 2’, ‘commune 3’ and ‘commune 4’ in Niamey region and Goure, Miriah and Zinder in Zinder region.

The average age of women that participated to the survey was 39.2 years (38.2–40.3), 79.1% (75.9–82.0) of them were married and 46.5% (42.8–50.3) from rural areas. Moreover, 48.4% (44.7–52.2) were not educated, only 5.5% (4.0–7.5) had higher education. The average number of children per woman was 4.6 (4.3–4.8). The average age of menarche was 14.1 years (13.9–14.3). Hausa remains the main ethnic group (53%) followed by Djerma (17%), 96.9% were Muslim, and 2.7% Christian. 43% (39.7–47.2) of the survey participants were ‘house women’ or unemployed while 20% (17.2–23.2) were vendors. Only 0.4% (0.2–1.3) of the responders smoke and 0.7% (0.3–1.7) drink alcohol. 75.6% (72.2–78.6) of the interviewed women had a breastfeeding attitude with 31% (26.9–55.2) doing exclusive breastfeeding. 42.2% (38.6–46.0) of women took oral contraception and 35.5% (32.2–39.4) contraception.

| Knowledge of symptoms                      | Yes | I dont| weighting | Score |
|--------------------------------------------|-----|-------|-----------|-------|
| - Change in the position of your nipple    | 1   | 0     | no        | 1     |
| - Pulling in off your nipple               | 1   | 0     | no        | 1     |
| - Pain in one of your breasts or armpits   | 1   | 0     | yes       | 2     |
| - Puckering or dimpling of your breast skin| 1   | 0     | no        | 1     |
| - Discharge or bleeding from your nipple   | 1   | 0     | no        | 1     |
| - Nipple rash                              | 1   | 0     | no        | 1     |
| - Redness of your breast skin              | 1   | 0     | no        | 1     |
| - Change in the size of your breast or nipple| 1   | 0     | yes       | 2     |
| - Change in the shape of your breast or nipple| 1   | 0     | yes       | 2     |
| - A lump or thickening in your breast      | 1   | 0     | yes       | 2     |
| - A lump or thickening under your armpit   | 1   | 0     | yes       | 2     |
| maximum weighted score for symptoms        | 16  |

| Knowledge of risk and protective factors   |      |      |       |      |
|--------------------------------------------|------|------|-------|------|
| - Alcohol intake                           | 1    | 0    | no    | 1    |
| - Smoking (chewing tobacco)                | 1    | 0    | no    | 1    |
| - Nulliparity and late maternity           | 1    | 0    | yes   | 3    |
| - Physical inactivity and obesity          | 1    | 0    | yes   | 2    |
| - Breastfeeding                            | 1    | 0    | yes   | 3    |
| - Early maternity                          | 1    | 0    | yes   | 2    |
| - Balanced diet and lifestyle              | 1    | 0    | no    | 1    |
| - Age                                      | 1    | 0    | yes   | 2    |
| maximum weighted score for risk and protective factors | 15 |

| Knowledge of Breast cancer good practice   |      |      |       |      |
|--------------------------------------------|------|------|-------|------|
| Breast self-exam (once a week or a month)  | 1    | 0    | yes   | 2    |
| Clinical examination (Yes or No)           | 1    | 0    | yes   | 2    |
| Mammography (Yes or No)                    | 1    | 0    | no    | 1    |
| maximum weighted score good practice       | 5    |
| Overall maximum knowledge score (symptoms + risk and protective factors + good practice) | 36  |
did not practice contraception at all. Finally, 28.3% (24.9–31.9) had an abortion history.

3.2. Overall knowledge of breast cancer

Table 2 shows that overall women's knowledge of breast cancer is low, only 41.6% (37.8–45.4) were aware of breast cancer following the retained definition (cf. knowledge score construction in methodology section). In the paragraphs below, we further discuss each dimension of breast cancer knowledge.

3.3. Women's knowledge of breast risk and protective factors

Overall women's knowledge of breast cancer risk and protective factors remains poor, it only reached 27.4% (24.0–31.0). Table 3 and Table 4 summarize women's appraisal of breast risk and protective factors.

Only 36.2% of the interviewed women were convinced that long term survival (longer than 5 years) is common when BC is treated in an early stage.

3.4. Women's knowledge of breast cancer warning signs

It could be seen from Table 5 that most of Niger women considered change of size 58.1% (54.4–62.2) and shape 57.8% (54.1–61.6) of their breast as a warning sign for BC. Change in the position of the nipple was considered as a warning sign by 65.8% (62.2–69.6) of women. Pain in one of your breasts or armpit was considered a symptom by 66.3% (62.8–70.2), discharge or bleeding from your nipple by 61.8% (61.8–65.6). “Redness” of your breast skin (adapted in this context as “Change in the colour aspect of the skin”) was considered as a symptom by 62.1% (58.1–65.6) and ‘A lump or thickening under your armpit’ by 64.5% (61–68.4). Pulling in of your nipple 48.9% (44.7–52.4), puckering or dimpling of your breast skin 46.4% (42.6–50.3) and ‘nipple rash’ 52.2% (48.1–55.7) were not considered by a (borderline) majority of women as breast cancer warnings signs.

In general, women had an overall acceptable level of knowledge of breast cancer symptoms 65% (61.3–68.7), anyhow, a higher level of knowledge was demonstrated here compared to the one regarding risk and protective factors.

3.5. Breast examination, mammography and history of screening participation

The proportion of women who did not have any history of participation in BC screening is relatively high as indicated in Table 6. The main reasons for not participating in breast cancer screening include the lack of facilities or hospital in the area 20.9% (15.3–26.4) and lack of money (transport) 34.9% (28.5–47.1). Nevertheless 8.5% (5.1–11.9) of the interviewed women declared not to participate in breast cancer screening because the doctor is a man. In Niger, very often screening is done through clinical breast examination. The extreme majority of women declared to go to the doctor once facing BC symptoms. Nevertheless, a minority expressed the attitude of going to a traditional healer. Some women declared family consultation as first reaction when confronted with BC symptoms. The majority intend to participate in BC screening in future. Some of them participated in cervical cancer and HIV screening in the past, but manifested more enthusiasm to breast cancer screening.

If we consider the knowledge of BC good practice as defined earlier, a pooled combination of (breast self-examination, clinical breast examination and mammography), only 16.9% (14.2–19.7) of women can be classified as being aware of breast cancer good practice.

3.5.1. Factors associated with knowledge of breast cancer

Table 7 shows the results of modelling of odds being “breast cancer aware” given socio demographic and specific predictors. We fitted both OLR and GEE models.

Considering OLR, we found the odds of being aware of breast cancer associated with age, breastfeeding practice, clinical breast examination, area, and participation to BC screening. In fact, the odds of being aware of BC is 3 times higher for a woman doing exclusive breastfeeding as compared to one who does not. The odds of being aware of BC of women doing clinical breast examination is twice that of a woman who is not doing clinical breast examination. Women that have participated in breast cancer screening are half as likely to be aware of breast cancer compared to those who don't participate. Younger women are more likely to be aware of breast cancer compared to older ones. Women in the capital city were less aware than women in the most populous township, even though administratively this is considered rural. This is more likely due to administrative classification, in fact, according to the latest General Population Census (Décret N° 2011-059/PCSRD/ME/F DU 27 Janvier, 2011), Niamey the capital city had a 95.2% rate of urbanization and many townships are classified rural while they have quite an urban profile, with growing population and middle income.

Considering GEE results, thus accounting for within health centre clustering, we found the following results. In fact, Niger women that consult in the same health centre are more likely to see the same health professionals and receive the same awareness programs. Clinical breast examination, age and area of residence were found to be associated with breast cancer knowledge. The odds of a woman that practices clinical breast examination is 2.25 higher than of one who is not. Urban women were less likely to be aware of breast cancer as compared to rural women. Younger women were more likely to be aware of breast cancer. We observed an association between knowledge of breast cancer good practice and number of children, women with more children were more likely to be aware of breast cancer good practice.

4. Discussion

Although the knowledge score was constructed somehow like a composite multidimensional score, overall women's knowledge of breast cancer in Niger was found to be low. Dimensions where women showed specific low levels are knowledge of breast cancer risk/protective factors and knowledge of “good practice”. The majority of women did not agree that smoking and alcohol are breast cancer risk factors. This could be explained by the insignificant proportion of women who smoke or drink in the survey sample, which is representative of the Niger community in general due to religious and personal beliefs. Smoking and alcohol use were documented historically to be low in Niger. Fewer women smoke in Niger than on average in low-HDI countries, adult women smoking (% using tobacco daily for above 15 years old) in 2015 is only 0.1%. According to the latest WHO data published in 2017, alcohol deaths in Niger stands only for 0.11% of total deaths. The age adjusted death rate is 1.80 per 100,000 of population. Alcohol morbidity prevalence estimates for men are 0.09 and 0.01 for women. Niger women also did not recognize physical inactivity and nulliparity as a breast cancer risk factor.

| Table 2. Women's overall knowledge of breast cancer. |
|-----------------------------------------------------|
| Women's knowledge of breast cancer | Overall knowledge % (95% CI) | Knowledge of symptoms | Knowledge of risk and protection factors | Knowledge of good practice |
| Aware | 41.6 (37.8–45.4) | 65.0 (61.3–68.7) | 27.4 (24.0–31.0) | 16.9 (14.2–19.7) |
| Not aware | 58.4 (54.6–62.2) | 35.0 (31.3–38.7) | 72.6 (69.0–76.0) | 83.1 (80.3–85.8) |
These findings correspond with those of Azubuike SO, 2017 who recently found a generally poor knowledge of BC among women in Benin city, Nigeria, whose knowledge concerning breast cancer risk factors was also worse than concerning signs and symptoms. Okobia et al., 2006 in a study in Nigeria also found participants to have a poor knowledge of breast cancer with a mean knowledge score of only 42.3%. Moreover, Kohler et al., 2017a, in a study in Malawi also found that women know more about breast cancer symptoms than about breast cancer risk factors, like in our study findings. Opeku, 2012 observed a low level of breast cancer knowledge within the women population in Ghana. A recent literature review on ‘‘Symptom awareness measures for breast and cervical cancer in Sub-Saharan Africa’’ conducted by Githaiga et al., 2017 summarized studies all reporting a generally low level of breast cancer awareness in the women population in sub-Saharan Africa. Only 27.0% (23.8–30.4) of Niger women have reported to practice clinical breast examination with a general practitioner, it should be noted that this was found to be associated with breast cancer knowledge. In fact, BC in Niger is done using clinical breast examination rather than mammography which is not available or widely accessible in the country. 32.7% (29.3–36.4) of women reported to practice breast self-examination. While breast self-examination is important, the meta-analysis conducted by Hackshaw and Paul, 2003 in Russia and China showed its low

| Table 3. Breast cancer risk factors. |
|-------------------------------------|
| Risk factors | Disagree | NAD | Agree |
| Alcohol intake | 37.8 % | 22 % | 40.2 % |
| Smoking | 23.6 % | 20.4 % | 56 % |
| Nulliparity and late maternity | 42.2 % | 28.1 % | 29.7 % |
| Physical inactivity and obesity | 39.3 % | 33.4 % | 27.3 % |

NAD: Neither agree nor Disagree.

| Table 4. Breast cancer protective factors. |
|------------------------------------------|
| Protective factors | Disagree | NAD | Agree |
| Breastfeeding | 31.9 % | 23.4 % | 44.7 % |
| Early maternity | 34 % | 30.4 % | 35.6 % |
| Balanced diet and lifestyle | 35.9% | 21.9 % | 42.2% |

| Table 5. Breast cancer warning signs. |
|--------------------------------------|
| Breast cancer warning signs | Yes | No | I don't know |
| Change in the position of your nipple: | 65.8 (62.2–69.6) | 25.9 (22.5–29.5) | 8.3 (6.2–10.4) |
| Pulling in off your nipple | 48.9 (44.7–52.4) | 39.9 (36.4–44.0) | 11.3 (9.0–13.8) |
| Pain in one of your breasts or armpit | 66.3 (62.8–70.2) | 24.3 (21.1–27.6) | 9.3 (7.1–11.6) |
| Puckering or dimpling of your breast skin | 46.4 (42.6–50.3) | 39.1 (35.6–42.9) | 14.4 (11.8–17.3) |
| Discharge or bleeding from your nipple: | 61.8 (61.8–65.6) | 28.0 (28.0–31.4) | 10.2 (10.2–12.6) |
| A lump or thickening in your breast | 60.1 (56.2–64.1) | 27.1 (23.4–30.4) | 12.8 (10.3–15.6) |
| Nipple rash | 52.2 (48.1–55.7) | 33.9 (30.6–37.7) | 14.0 (11.4–16.9) |
| “Redness” of your breast skin | 62.1 (58.1–65.6) | 27.7 (24.4–31.3) | 10.1 (7.7–12.5) |
| A lump or thickening under your armpit | 64.5 (61–68.4) | 26.7 (23–30.4) | 8.8 (6.7–11) |
| Change in the size of your breast or nipple | 58.1 (54.4–62.2) | 30.2 (26.8–33.8) | 11.7 (9.3–14.3) |
| Change in the shape of your breast or nipple | 57.8 (54.1–61.6) | 29.4 (26.3–32.9) | 12.7 (10.3–15.4) |

| Table 6. Screening, intention, attitudes and practice of women related to BC. |
|-----------------------------|----------------|----------------|
| Screening, attitudes and practice of women | Yes - % (95% CI) | No - % (95% CI) |
| Did you participate in BC screening in the past? | 25.2 (22.1–28.6) | 74.7 (71.3–77.8) |
| Do you intend to participate to BC screening? | 65.2 (61.5–68.7) | 34.8 (31.3–38.5) |
| Did you already undergo a mammography? | 20.1 (17.3–23.3) | 79.6 (76.3–82.4) |
| Did you practice BSE? | 32.7 (29.3–36.4) | 67.1 (63.5–70.5) | % (95% CI) |
| How often do you practice BSE? | Rarely | 53.4 | (48–60.6) |
| | A least once in 6 months | 23.1 | (17.6–29) |
| | At least once a month | 16.3 | (11.8–21.7) |
| | At least once a week | 6.3 | (3.2–9.5) |
| What do you do if you have BC symptoms? | Go to doctor | 93.8 | (91.7–95.4) |
| | Consult my family | 3.3 | (2.2–4.9) |
| | Traditional healer | 2.2 | (1.4–3.6) |
| | Buy drugs myself | 0.7 | (0.3–1.7) |
younger women having more awareness than older ones, in line with Okobia et al. (2006) and Opoku (2012). We found age to be associated with breast cancer awareness with A. Abdou et al. (2020). Nevertheless, some studies established an association between breast cancer awareness and educational level in sub-Saharan Africa, mammography should not be the way forward regarding screening and early detection (Black and Richmond, 2019). 3.7% (2.4–5.3) of women participated in HIV and cervical cancer screening in the past.

We found that women living in urban and peri urban areas to be less likely to be aware of breast cancer compared to those living in rural areas. Niamye being the capital city, almost all women consult a doctor in an urban health centre though these are administratively conceived to be rural contrasting the recent urbanization phenomena. Ann Muthoni and Ann Neville Miller, 2010 revealed a difference between rural and urban Kenyan women's knowledge and attitudes regarding BC and BC early detection measures in a qualitative study. In fact, urban middle-income women were more informed about breast cancer risk factors and early detection measures as compared to other groups including urban low income and rural low-income women. Women with history of participation to breast cancer screening were half as likely to be aware of BC compared to those who don't participate, this is surprising, maybe women who know less on breast cancer are the ones more motivated to participate to screening.

Educational level was not found to be associated with breast cancer awareness. It should be noted that in the general women population, educational level in Niger is not that much heterogenous, in our sample only 5.5% had higher education. Trupe et al., 2017 in a study in Limpopo, South Africa, could not find an association nor between educational level neither between age on the one hand and breast cancer awareness on the other hand. Nevertheless, some studies established an association between breast cancer awareness and educational level in sub-Saharan African context in Nigeria (Okobia et al., 2006) and in Ghana (Opoku, 2012). We found age to be associated with breast cancer awareness with younger women having more awareness than older ones, in line with findings by Allam and Abd Elaziz 2012. (Azbubike et al., 2018) stated that younger age profile of BC women in sub-Saharan Africa is subject to controversies.

### 5. Conclusion

Niger women were found to have a relatively low level of breast cancer awareness. Knowledge of risk/protective factors and breast cancer good practice were main factors downsizing this knowledge. Meanwhile women's knowledge of breast cancer symptoms appeared to be acceptable. Clinical breast examination, age, area of residence, breastfeeding and history of participation in breast cancer screening were found to be associated with breast cancer knowledge using OLR. Using GEE, only clinical breast examination, age and area of residence were found to be associated with overall breast cancer knowledge.

This study reported an overview of Niger's women knowledge of breast cancer and can contribute in guiding awareness programs for screening/early detection. Awareness programs in Niger should promote clinical breast examination, as mammography is not common, and target older women, both in rural and urban areas, with focus on breast cancer risk/protection factors. Participation to breast cancer screening should be encouraged.

### 5.1. Limitations

The limitation of this study could find its root in the fact that it was conducted in the two regions of Zinder and Niamye, which historically host national reference hospitals. The study could therefore contain bias in terms of reproducibility in the whole country. Results need to be interpreted within the regions framework. Lack of wide access to equipment of mammography could introduce a bias in the proportion of women reporting having undergone a mammography, as during the period of the survey (January 2018), only one mammography machine was available in the whole country and was in the capital city.

### 6. Policy recommendations

- Focus breast cancer awareness programs on knowledge of breast cancer risk/protective factors and breast cancer good practice as these are areas of which women know the least.
- Support the implementation of cancer national policy in the country with support of WHO
- Awareness programs should target different age classes but focus on older women
- Design a strategy to shift from a clinical breast examination to a mammography screening program in Niger.
- Provide and decentralise mammography units and build multilateral partnerships to support women to have financial access to breast cancer screening.
- Design a strategy to encourage women to participate in breast cancer screening
- A national cancer policy should include awareness programs that are designed to increase earlier diagnosis of symptomatic BC disease.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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**Table 7. Generalized linear model results: Being aware of breast cancer (OLR and GEE).**

| Risk factors                  | OLR B coef (P-value) | Adjusted OLR – (95% CI) | Adjusted OLR P-value | Exp-Coef GEE (P-value) |
|------------------------------|----------------------|-------------------------|----------------------|------------------------|
| Intercept                    | 0.32 (0.80)          | 0.98 (0.96–0.99)        | 0.008                | 0.98 (0.055)           |
| Age                          | -0.02 (0.008)        | 1.11 (0.99–1.22)        | 0.085                | 1.03 (0.448)           |
| Menstrual age                | -0.04 (0.75)         | 0.99 (0.51–1.91)        | 0.989                | 0.83 (0.579)           |
| Zone (urban/rural)           | -1.242 (-0.001)      | 0.29 (0.20–0.44)        | <0.001               | 0.34 (-0.001)          |
| Children number              | 0.03 (0.37)          | 1.04 (0.96–1.12)        | 0.377                | 1.09 (0.740)           |
| Breastfeeding practice       | -0.39 (-0.08)        | 0.68 (0.44–1.05)        | <0.08                | 1.17 (0.540)           |
| Exclusive breastfeeding      | 1.20 (-0.001)        | 3.34 (2.12–5.26)        | <0.001               | 1.34 (0.135)           |
| Breast self-examination      | -0.09 (0.60)         | 0.90 (0.60–1.36)        | 0.671                | 1.20 (0.550)           |
| Clinical breast examination  | 0.71 (-0.001)        | 2.04 (1.31–3.16)        | 0.003                | 2.25 (-0.001)          |
| Breast cancer screening      | -0.64 (0.004)        | 0.53 (0.34–0.82)        | 0.004                | 0.87 (0.517)           |
| Other screening              | -0.30 (0.51)         | 0.74 (0.30–1.84)        | 0.521                | 1.30 (0.582)           |

Hosmer and Lemeshow goodness of fit (GOF) test: $X^2 = 20$, df = 8, p-value = 0.007.

impact on mortality. 79.6% (76.3–82.4) of women have never had a mammography which is only available at central level. It's often documented that in sub-Saharan Africa, mammography should not be the way forward regarding screening and early detection. Women's knowledge of breast cancer symptoms appeared to be acceptable. Clinical breast examination, age, area of residence, breastfeeding and history of participation in breast cancer screening were found to be associated with breast cancer knowledge using OLR. Using GEE, only clinical breast examination, age and area of residence were found to be associated with overall breast cancer knowledge.

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Declarations

Author contribution statement

A. Abdou: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools and data; Wrote the paper.

G. Van Hal: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

I. Dille: Conceived and designed the experiments; Wrote the paper.

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The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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