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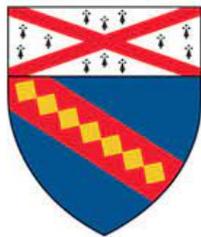
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Knowledge, Attitudes, and Practices Concerning Breast Cancer,
Cervical Cancer, and Screening Among Healthcare Professionals
and Students in Mogadishu, Somalia

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Abstract

Background: Somali women face exceptionally high mortality and incidence rates from both breast and cervical cancer. They experience an age-standardized breast cancer mortality rate of 29.1 per 100,000 women, the highest in all of Africa, and an age-standardized breast cancer incidence rate of 41.7 per 100,000 women. Somalia's second-highest cancer-related mortality and incidence rates are due to cervical cancer, both behind breast cancer. It is critical to identify the underlying factors that may influence healthcare workers' management of both cancers. At present, there is no consensus regarding providers' knowledge of different cancers and screening.

Methods: A cross-sectional questionnaire was administered with a purposive sampling strategy to 469 healthcare professionals and students and was completed by 405 (86%). Healthcare workers were recruited from Mogadishu-based hospitals.

Results: 197 healthcare professionals and 207 students completed the survey and were included in the analysis. 89% and 73% of respondents demonstrated good knowledge of breast and cervical cancer, respectively. Only 46% knew that a vaccine could prevent cervical cancer, and 89% of healthcare professionals disagreed that HPV vaccines were available to their patients. Attitudes towards cancer screening, in addition to breast self-examination, were overwhelmingly positive. For both breast and cervical cancer, 24% reported having treated a patient and 30% reported having conducted a screen for either disease.

Conclusion: Overall, while knowledge of both diseases and screening was good, there remain areas for clear educational targeting such as HPV vaccine availability and breast cancer preventability. Attitudes to screening for both diseases were exceedingly positive, but, with the exception of breast self-examination, failed to translate into practice due to inadequate resources and patient refusal. Future investments into Somalia's chronic care management should prioritize technology necessary to conduct screenings for both diseases, expanding HPV vaccine access, and understanding patients' potential motivations for refusing screening at the current moment.

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Introduction

Breast cancer (BC) is the most frequently diagnosed cancer among women globally, with an estimated 2.3 million new cases in 2020.¹ In addition, BC is also the worldwide leader in female cancer deaths, claiming an estimated 685,000 lives in 2020.¹ In contrast to many high-income countries where the incidence and mortality of BC have remained fairly consistent, these measures have rapidly increased in lower-income countries undergoing an epidemiological transition.^{2,3} Mortality has increased rapidly in Africa, which experiences an age-standardized BC mortality rate of 19.4 per 100,000 people, higher than any other continent.¹ Due to several contributing factors including scarce cancer diagnostic facilities,⁴ persistently long wait times,⁵ and limited cancer education,^{5,6} many women present with late-stage disease, heightening their risk for mortality.

Patients' knowledge and attitudes toward BC are essential determinants of early detection, and it is well-established that the early diagnosis of BC is effective at reducing mortality rates.^{7,8} Yet, the evidence concerning stakeholders' perceptions and knowledge of BC and screening programs in some low- and middle-income countries (LMICs) remains sparse. Furthermore, breast self-examinations (BSE) have been known as a cost-effective intervention with the potential to assist in the early detection of BC,^{9,10} empower women to take a role in their health promotion,^{11,12} and may encourage future professional breast examinations,¹³ but attitudes toward BSEs remain unexplored in many LMICs.

Globally, there were an estimated 570,000 new cervical cancer (CC) cases as well as an estimated 311,000 deaths attributed to the disease in 2018.¹⁴ CC has also been found to be the leading cause of cancer-related deaths in women in many African countries.¹⁴ Furthermore, the incidence of the disease has been found to be increasing in almost every sub-Saharan African

country for which data are available.¹⁵ The region is known to have the greatest age-standardized incidence rate of CC in the world,¹⁵ as about 90% of the world's CC cases occur in sub-Saharan Africa.¹⁵

CC is a preventable disease; modeling studies demonstrate that, with widespread, high-coverage scale-up of Human Papillomavirus (HPV) vaccination and screening services, the elimination of this disease is possible.¹⁶ These screening programs can be radically effective in conjunction with the highly efficacious bivalent and quadrivalent HPV vaccines in addition to widespread Pap testing.^{14 15}

Somali women face exceptionally high mortality and incidence rates from both BC and CC. They experience an age-standardized BC mortality rate of 29.1 per 100,000 women, the highest in all of Africa,¹⁷ and an age-standardized BC incidence rate of 41.7 per 100,000 women.¹ Somalia's second-highest cancer-related mortality and incidence rates are due to CC, both behind BC.¹ Additionally, it is hypothesized that these numbers are underreported as qualitative studies of Somali refugees have demonstrated a preference of women to avoid CC screening due to a fear of the disease and a preference to die without knowing that they have cancer.¹⁸

Somali women have some of the lowest health indicators in the world, with a life expectancy of 59 years.¹⁹ They face many barriers in utilizing their country's healthcare system, including a lack of consistent electricity at about half of surveyed healthcare facilities in Somalia.²⁰ Persistent unaffordable prices and a lack of regulation have resulted in general distrust towards the nation's healthcare system, leading to reports of poor care-seeking behavior among Somalis.²¹ Moreover, prolonged conflict by way of thirty years of civil war has severely damaged the country's healthcare infrastructure, leaving its inhabitants vulnerable to climate-related disasters and a lack of consistent care for chronic conditions.^{22 23}

Currently, Somalia does not have an HPV vaccination program and its Ministry of Health reports that HPV vaccines are unavailable throughout the country.²⁴ Additionally, informal conversations with hospital leaders in Mogadishu have revealed that mammography equipment are also widely unavailable, forcing physicians to turn to alternative breast cancer screening methods, such as clinical histories, biopsies, and ultrasounds.

It is critical to explore the individual and institutional elements that may inhibit comprehensive cancer care in Somalia, especially as they pertain to healthcare workers' practice of early detection of both cancers. At present, assessments of providers' knowledge of different cancers and screening in the Horn of Africa provide conflicting reports. A study of Ethiopian female healthcare workers demonstrated relatively high knowledge concerning CC,²⁵ while another study among Eritrean nurses showed poor knowledge of BC risk factors.²⁶ A final study among urban health extension workers in central Ethiopia found that over half of respondents had BSE knowledge that did not necessarily translate into clinical practice.²⁷ However, healthcare workers ultimately have the potential to promote patient knowledge regarding cancer screening on a large scale.²⁸ By supporting their ability to translate knowledge into practice, empowered healthcare workers can be effective patient educators.²⁶

To our knowledge, this study serves as the first investigating Somali healthcare professionals' and students' knowledge, attitudes, and practices (KAP) toward breast cancer, cervical cancer, and screening in Somalia.

Methods

Design and Instrument

A descriptive, cross-sectional KAP study among healthcare professionals and students concerning BC, CC, and screening practices was carried out in Mogadishu, Somalia from February 15th, 2021 until March 28th, 2021. The 40-item survey tool consisted of 8 sections: demographic information, knowledge, attitudes, and practices regarding both cancers, and a separate section specific to BSE. Kress et al. examined the KAP concerning CC and screening among nurses, midwives, medical students, general practitioners, internists, pediatricians, and obstetricians/gynecologists in Ethiopian hospitals.²⁹ Their survey were adapted to include questions pertaining to BC, BC screening, and BSE from two other studies examining healthcare providers' KAP in the African continent.^{26,30} The English questionnaire was translated to and from Somali language by the data collectors and was available both in print and online format. In order to permit comparison to published investigations in neighboring countries, a threshold of $\geq 50\%$ of questions answered correctly was adopted to signify a “good” knowledge level.

In order to minimize experimenter bias, multilingual healthcare professionals from the Hagarla Institute, a Mogadishu-based non-profit organization dedicated to furthering clinical research, capacity-building, and skills transfer for medical personnel across Africa, underwent training as data collectors at SIMAD University's Institute for Medical Research.

Sample and Setting

The survey was administered to 469 Mogadishu-based healthcare professionals and students and was completed by 405 participants with a 86% completion rate. To counter bias stemming from nonresponse, an *a priori* determination was made to remove data from participants who did not respond to at least 85% of questions.

A purposive sampling method was utilized to survey healthcare professionals and students from healthcare-delivering institutions near Mogadishu, Somalia. Due to their direct involvement in

Somali women's potential cancer care, the survey aimed to receive responses from medical students, midwives, general ward nurses, head nurses, obstetrician/gynecologists, radiologists, and general surgeons. The purposive sampling strategy was employed to compensate for an inability to access employee registries at participating institutions from which to randomly sample and to ensure a sufficient amount of responses from a variety of patient-facing healthcare workers that provide BC or CC care to patients. Participants were mostly recruited from the following hospitals in Mogadishu: Dr. Sumait Hospital at SIMAD University, Banadir Hospital, Madina Hospital, Racep Tayyip Erdoğan Hospital, Keysaney Hospital, Dr. Hawa Abdi Hospital, Somali University Hospital, Somali-Syrian Hospital, Shaafi Hospital, and Daynile Hospital.

Data Analysis

Responses were either collected directly in Qualtrics or were manually input onto the survey software in English. Data were exported for analysis on SAS Studio v.9.4.³¹ Descriptive statistics are reported using median and standard deviation calculations for continuous variables, along with frequency and percentages of responses for categorical variables. Bivariate and multivariate logistic regression analyses were utilized to examine how pre-existing attitudes and levels of knowledge may predict variables of interest, such as frequency of screening procedures completed. An alpha of 0.05 was utilized for all analyses.

Ethical Considerations

This study received approval from the ethics board at SIMAD University's Institute for Medical Research and was deemed exempt from review by the Yale IRB (ID #2000029594). Verbal informed consent was obtained by the researchers by way of a brief presentation regarding the investigation's purpose, procedures, and requirements for participation. Potential participants were made aware that participation was voluntary and could be withdrawn at any moment, that their responses would be anonymous and confidential, and that their participation would in no

way impact their relationship with their employer. Data collectors received monetary compensation for their time and effort.

Results

The survey received 405 complete responses. Participants who did not respond to at least 85% of the questions were removed from the analysis. All non-demographic questions had an option of “I don’t know” or “prefer not to say” to minimize this. One survey response from a participant who did not identify themselves as either a healthcare professional or student was excluded. The final analysis was conducted with 404 responses.

Of the included responses, 49% were self-identified healthcare professionals, and 51% were health professional students. Among healthcare professionals, the highest sampled professions were general ward nurses (25%) and midwives (19%). Many students (42%) did not associate with any of the provided options, likely due to participating in the study before differentiating into specialties. The mean age of participants was 29.9 (SD \pm 8.37), and 59% of respondents were female. Of practicing healthcare professionals, over 60% had been practicing for less than five years (**Table 1**). The most common affiliation among participants was with Banadir Hospital in Mogadishu.

Eighty-nine percent of included participants had a good knowledge of BC, correctly answering at least 9/18 questions pertaining to BC risk factors, severity, and burden, while 61% showed superior knowledge by answering at least 12/18 questions correctly. Five questions were answered correctly by less than 50% of the sample. Two were regarding risk factors: *First birth occurring after mother is \geq 30 years old* (49%); *Use of oral contraceptive pills* (46%), while the others related to those-at-risk and preventability of the disease: *Breast cancer is preventable*

(8%); *Breast cancer is most common among women in their 20s* (45%); *Only women can get breast cancer* (46%) (**Table 2**). Healthcare professionals and students differed in their knowledge of risk factors; professionals were significantly more likely to recognize five (non-)risk factors: *History of smoking* (92% vs 82%); *Family history of breast cancer* (97% vs 89%); *No history of breastfeeding* (82% vs 73%); *Having multiple sex partners* (non-risk factor; 80% vs 65%); *Larger breasts* (non-risk factor; 65% vs 49%). Students correctly identified two risk factors at a significantly higher rate than healthcare professionals: *First birth occurring after mother is ≥ 30 years old* (36% vs 63%); *Use of oral contraceptive pills* (30% vs 63%).

Respondents had relatively less knowledge of CC. Seventy-three percent of respondents correctly answered at least 10/19 questions pertaining to CC, and 56% correctly responded to at least 12/19 questions. In addition to this poor overall performance, responses to CC questions exhibited more heterogeneity; more questions had significantly different response patterns across professional and student groups when compared to BC (**Table 2**). Healthcare professionals were statistically more likely to answer CC risk factor questions correctly across the board but were statistically less likely to answer the following questions about CC screening and presentation: *Cervical cancer can usually be found at an early stage because of the obvious symptoms* (False; 23% vs 33%); *Cervical cancer is most common among women in their 20s* (False; 43% vs 62%). Of note, slightly above 50% of respondents correctly identified that there is a licensed vaccine that can prevent CC; healthcare professionals were statistically more likely to identify the existence of such a vaccine (65% vs 42%). Additionally, only 26% and 43% of respondents correctly identified that poor personal hygiene and use of intrauterine devices were not risk factors for CC, respectively.

Attitudes towards screening were overwhelmingly positive for both cancers. Over 98% of respondents agreed that both BC and CC are serious diseases, that screening for both diseases

is an essential part of women's healthcare, and that a screening program for both cancers should be initiated in their community (**Table 3**). Relative to patients' other needs, however, respondents were not as concerned about BC and CC screening, with over 92% stating that their patients have more pressing concerns than cancer screenings. Respondents also reported that a lack of resources inhibited screening, with over 96% reporting that they lacked two or more fiscal or technological resources required for screening. Among other barriers to screening reported, 30% of respondents reported patients refusing opportunities for BC or CC screens.

Most respondents reported not having cared for breast and CC and precancerous patients. About 24% reported having treated either BC or CC patients (**Table 4**), while 30% reported having ever conducted a BC or CC screening examination (**Figure 1**). Moreover, over 95% of respondents had a positive attitude towards the efficacy of BSEs (**Table 5**). Additionally, 92% were confident that they could detect abnormalities in breasts, and about 79% recommend that their patients conduct breast-examinations and felt confident about their ability to teach the technique to patients.

Discussion

To our knowledge, this is the first study to investigate Somali healthcare professionals' and students' knowledge, attitudes, or practices towards BC, CC, and screening for both diseases. The study utilized a purposive sampling technique to avoid neglecting any type of healthcare worker providing cancer care to Somali women, particularly midwives who play an invaluable role in providing reproductive health services across the nation.³² A large majority (89%) of respondents demonstrated a good knowledge of BC prevention and screening, risk factors, severity, and burden. This study provides evidence of Somali healthcare workers' higher levels of BC knowledge compared to participants in nearby Northwest Ethiopia,³³ Addis Ababa in Central

Ethiopia,^{27 34} and Eritrea.²⁶ As expected, healthcare professionals performed better than students at identifying BC risk factors. Surprisingly, a majority of healthcare professionals said that BC was most common in women in their 20s, potentially a reflection of growing trends of early onset BC plaguing sub-Saharan African populations.³⁵ Also of note, overwhelming majorities of both professionals (94%) and students (89%) stated that BC was a preventable disease.

With regards to CC, a majority (73%) of healthcare professionals and students demonstrated good knowledge. While lower than the BC scores, the current finding is higher than that of other sub-Saharan investigations in Tanzania and Côte d'Ivoire,^{36 37} and lower than that of Ethiopia and Nigeria.^{25 38 39} While only 54% of professionals and students knew that there was a vaccine available that could prevent CC, this is a higher rate than that identified in southern Ethiopia (36%).²⁵

Furthermore, there is reason to believe that healthcare professionals from other provinces of Somalia would demonstrate a worse knowledge of both cancers and screening practices. While Mogadishu-based medical universities' curricula inform students about CC, BC, screenings, and HPV, the unavailability of screening equipment make it difficult to reinforce these concepts with practice. This effect may be heightened in more rural areas and smaller cities within Somalia where screening equipment is even less prevalent. In addition, the Somali Medical Association encourages attendance of biannual *Continuing Medical Education* events to reinforce established and introduce new concepts to graduated medical professionals.⁴⁰ These events are only hosted in Somalia's largest cities.

Attitudes towards screening of both diseases proved remarkably positive. While 99% and 98% of respondents stated that screening for BC and CC was an essential part of women's healthcare, respectively, a lack of access to services necessary for prevention and early detection of both

diseases was reported. Furthermore, over 97% of respondents reported a lack of access to services essential for proper screening of either cancer, including laboratory equipment, money dedicated for screening tests, and follow-up capacity. Moreover, attitudes towards BSE were also exceedingly positive. Without a comprehensive BC screening program in place, widespread BSE may serve as an acceptable alternative for Somali women to become familiar with any changes in their breast, despite the method's limitations.

The vast majority (89%) of healthcare professionals disagreed with HPV vaccines being accessible for their patients, reinforcing the vaccine's widespread unavailability in the nation.²⁴ Data concerning HPV's prevalence in at-risk populations or confirmed cervical cancer cases remain unavailable.²⁴ Before being able to guide primary or secondary cervical cancer prevention strategies, a comprehensive dedication to national HPV surveillance is required. In order to combat the second-leading cause of national cancer-related mortality,¹ it is imperative that international organizations such as GAVI, for which Somalia is eligible,⁴¹ deliver aid to the sub-Saharan African country in the form of HPV vaccinations.

While Somali healthcare professionals and students demonstrated a robust approval of screening, they did not practice in a concordant manner, with almost 70% of respondents having never conducted a screening for either disease. A healthcare professional's supervisory presence is required for Somali healthcare students to conduct screenings or offer recommendations. Students exclusively assist professionals as part of a cancer patient's treatment team. While the availability of resources, both technological and human, reportedly played a substantial role in precluding healthcare workers from conducting screening, 30% of respondents reported a patient having refused screening for either cancer. These respondents reported in vast agreement that their patients refused screening for either cancer because it was looked down upon by friends or family, because they believed it would give them cancer, because they found it embarrassing,

intrusive, or painful, among other reasons. An exception to this lack of screening practice was that of BSE, where 79% and 82% of respondents respectively reported frequently recommending that patients conduct BSEs and expressed confidence in their ability to teach the method. While cancer implementation science remains essential to discover the most effective way by which to launch screening programs for both diseases, we expect that other logistical and fiscal challenges related to scale-up would supersede that of Somali healthcare worker pushback and noncompliance.

Further investigations will need to evaluate BC and CC screening in the Somali context. A monetary and technological investment is necessary to improve Somali healthcare workers' ability to offer BC and CC screenings – a needs assessment evaluating the current infrastructure status and deficits is vital to understanding where to direct new commitments from governmental and international institutions. In addition, it will be impossible to improve uptake and minimize refusals without launching qualitative studies meant to understand the cultural nature of the stigma that surrounds and inhibits screening for both cancers. Finally, future investigations will need to assess Somali women's knowledge and attitudes of cancer screenings in order to target future educational initiatives to potential deficits. This study aimed to fulfill a similar gap; educational initiatives will need to be targeted to increase healthcare workers' understanding of BC preventability, CC risk factors, and HPV vaccinations.

Conclusion

This study is the first of its kind to examine the knowledge, attitudes, and practices of Somali healthcare workers as it relates to breast cancer, cervical cancer, and screening. While knowledge of both diseases and screening was generally good, there remain areas for clear educational targeting, such as the preventability of breast cancer and the existence of a vaccine

that can prevent cervical cancer. Attitudes to screening for both diseases were all exceedingly positive, but failed to translate into practice due to inadequate resources and patient refusal. Attitudes toward breast self-examination were also remarkably positive and did translate to clinical recommendations. Future investments into Somalia's chronic care management should prioritize technology necessary to conduct screenings for both diseases, expanding access to HPV vaccines, and understanding patients' potential motivations for refusing screening at the current moment.

Limitations

As the conducted investigation was cross-sectional and survey-based in nature, recall and social desirability biases are among the study's potential limitations. Furthermore, a second wave of COVID-19 cases has plagued Somalia and the Mogadishu area in February and March of 2021, when the study was in the data collection stage; the added time and emotional strain may have influenced the selection of participants. We attempted to mitigate this by eliminating individuals who completed less than 85% of the survey, who may have been stressed for time and skipped past questions. Lastly, as the study utilized a purposive sample of Mogadishu-based healthcare professionals and students, it is not intended to be a representative sample of Somali healthcare workers. Its generalizability is therefore limited.

Declarations

Ethics approval and consent to participate: This study received approval from the ethics board at SIMAD University's Institute for Medical Research in Somalia and was deemed exempt from review by the Yale IRB (ID #2000029594). Verbal consent to participate in the study was obtained privately from each participant prior to the survey being interviewer-administered by trained staff from the Hagarla Institute. If a participant consented, they were informed of their right to withdraw at any time without any consequences and were presented with a brief overview of the study

before any survey questions were administered. All information collected was confidential and anonymized.

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Table 1 Participant Demographics*

Characteristic	Healthcare Professionals (n=197)	Healthcare Students (n=207)	Total (n=404)
Age (years)			
≤25	27 (13.7)	118 (58.7)	145 (36.4)
26-35	106 (53.8)	67 (33.3)	173 (43.5)
36-45	50 (25.4)	11 (5.5)	61 (15.3)
≥46	14 (7.1)	5 (2.5)	19 (4.8)
Sex			
Male	85 (43.2)	81 (39.3)	166 (41.2)
Female	112 (56.8)	125 (60.7)	237 (58.8)
Profession			
Midwife	37 (18.8)	17 (8.2)	54 (13.4)
General Ward Nurse	50 (25.4)	45 (21.8)	95 (23.6)
Head Nurse	23 (11.7)	12 (5.8)	35 (8.7)
General Surgeon	17 (8.6)	20 (9.7)	37 (9.2)
Radiologist	26 (13.2)	5 (2.4)	31 (7.7)
Obstetrician/Gynecologist	23 (11.7)	21 (10.2)	44 (10.9)
Other	21 (10.7)	86 (41.8)	107 (26.6)
Licensed (Certificate) [†]			
Yes	98 (50.0)	-	98 (50.0)
No	98 (50.0)	-	98 (50.0)
Years of Practice [†]			
<1	25 (12.8)	-	25 (12.8)
1-5	94 (48.2)	-	94 (48.2)
6-10	52 (26.7)	-	52 (26.7)
≥11	24 (12.3)	-	24 (12.3)

* Values are frequency (column percent). Values may not add to 100 due to rounding

[†] Questions were only posed to Healthcare Professionals (as opposed to Students)

Table 2 Knowledge concerning breast and cervical cancer risk factors, etiology, and prevention

Question	Healthcare Professionals	Healthcare Students	Total	P-value [†]
	Correct Answer*			
BREAST CANCER				
History of smoking (Risk Factor)	176 (91.7)	154 (81.5)	330 (86.6)	0.0035
Family history of breast cancer (Risk Factor)	191 (97.4)	172 (89.1)	363 (93.3)	0.0010
No history of breastfeeding (Risk Factor)	58 (81.9)	136 (73.1)	294 (77.6)	0.0413
Having multiple sex partners (Non-Risk Factor)	144 (80.4)	112 (64.7)	256 (72.7)	0.0009
First birth occurring after mother is ≥30 years old (Risk Factor)	65 (36.1)	108 (63.2)	173 (49.3)	<0.0001
Obesity (Risk Factor)	137 (74.9)	122 (69.7)	259 (72.4)	n.s.
Increased age (Risk Factor)	134 (70.9)	125 (70.2)	259 (70.6)	n.s.
Use of oral contraceptive pills (Risk Factor)	56 (30.3)	108 (63.2)	164 (46.1)	<0.0001
Larger breasts (Non-Risk Factor)	120 (64.9)	86 (48.6)	206 (56.9)	0.0018
Breast cancer is one of the leading causes of death in women worldwide (True)	187 (95.4)	173 (86.5)	360 (90.9)	0.0020
Breast Cancer is preventable (False)	12 (6.2)	20 (10.9)	32 (8.5)	n.s.
It is possible to detect pre-cancerous breast tissue cells (True)	186 (95.4)	177 (92.1)	363 (93.8)	n.s.
The purpose of screening for breast cancer is to detect pre-cancerous changes and the appearance of cancer (True)	180 (92.8)	174 (90.6)	354 (91.7)	n.s.
If untreated, breast cancer can be fatal (True)	181 (93.8)	180 (93.3)	361 (93.5)	n.s.
Breast cancer is not curable (False)	143 (75.3)	130 (67.7)	273 (71.5)	n.s.
Breast cancer is most common among women in their 20s (False)	70 (37.8)	93 (52.8)	163 (45.2)	0.0042
Only women can get breast cancer (False)	94 (49.0)	81 (43.6)	175 (46.3)	n.s.
Any woman is at risk for breast cancer (True)	139 (72.4)	143 (77.7)	282 (75.0)	n.s.
CERVICAL CANCER				
Smoking cigarettes (Risk Factor)	175 (92.6)	128 (67.0)	303 (79.7)	<0.0001

Poor personal hygiene (Non-Risk Factor)	48 (25.8)	50 (27.0)	98 (26.4)	n.s.
Having multiple sex partners (Risk Factor)	163 (86.7)	144 (80.0)	307 (83.4)	n.s.
Use of herbal remedies (Non-Risk Factor)	111 (62.0)	74 (46.0)	185 (54.4)	0.0030
Use of tampons (Non-Risk Factor)	141 (77.0)	107 (62.9)	248 (70.2)	0.0038
Infection with HPV (Risk Factor)	157 (82.2)	129 (77.2)	286 (79.9)	n.s.
Infection with HIV (Risk Factor)	142 (77.6)	105 (58.3)	247 (68.0)	<0.0001
Use of IUDs (Non-Risk Factor)	87 (48.3)	63 (37.3)	150 (43.0)	0.0371
Cervical cancer is one of the leading causes of death in women worldwide (True)	161 (82.6)	140 (71.8)	301 (77.2)	0.0113
Cervical cancer is preventable (True)	157 (83.1)	150 (83.8)	307 (83.4)	n.s.
It is possible to detect pre-cancerous cervical cells (True)	188 (96.4)	177 (94.2)	365 (95.3)	n.s.
The purpose of screening for cervical cancer is to detect pre-cancerous changes and the appearance of cancer (True)	183 (94.8)	178 (94.7)	361 (94.8)	n.s.
If untreated, cervical cancer can be fatal (True)	180 (93.3)	172 (90.5)	352 (91.9)	n.s.
Cervical cancer is caused by a virus that is spread sexually (True)	136 (76.8)	100 (58.8)	236 (68.0)	0.0003
There is a vaccine that can prevent cervical cancer (True)	114 (65.1)	61 (41.5)	175 (54.4)	<0.0001
Cervical cancer is not curable (False)	136 (70.1)	117 (65.7)	253 (68.0)	n.s.
Cervical cancer is most common among women in their 20s (False)	81 (43.6)	112 (62.2)	193 (52.7)	0.0003
For cervical cancer, the progression of pre-cancerous cells to cancer can take 10-20 years (True)	73 (42.9)	75 (46.8)	148 (47.6)	n.s.
Cervical cancer can usually be found at an early stage because of the obvious symptoms (False)	45 (23.4)	60 (33.0)	105 (28.1)	0.0404

* Values are frequency (percent). "I don't know" responses were coded as missing.

† P-value is for χ^2 test between Healthcare Professionals and Healthcare Students.

Sources: ^{26 29 30 42-44}

Table 3 Attitudes concerning breast cancer, cervical cancer, and barriers to screening

Question	Healthcare Professionals	Healthcare Students	Total	P-value [†]
	Strongly/Somewhat Agree*			
BREAST CANCER				
Breast cancer screening is an essential part of women's healthcare	193 (99.0)	201 (99.0)	394 (99.0)	n.s.
Breast cancer is a very serious disease	193 (99.0)	196 (99.5)	389 (99.2)	n.s.
A breast cancer screening program should be started or expanded in my community	193 (99.0)	190 (97.9)	383 (98.5)	n.s.
My patients have more pressing health problems than screening	187 (96.9)	166 (87.8)	353 (92.4)	0.0008
I have not had the necessary training in order to screen	138 (71.1)	156 (82.5)	294 (76.8)	0.0082
The screening tests are too expensive for my patients	126 (65.0)	148 (81.3)	274 (72.9)	0.0004
I do not have time or am too busy to screen	89 (45.9)	95 (51.4)	184 (48.6)	n.s.
I do not have the necessary equipment or supplies to screen	168 (86.2)	153 (79.3)	321 (82.7)	n.s.
The screening procedures are too difficult	96 (49.2)	100 (57.1)	196 (53.0)	n.s.
I do not have the necessary laboratory resources to screen	177 (92.2)	156 (84.3)	333 (88.3)	0.0174
I do not have the capacity to follow-up with patients after screening	116 (61.0)	135 (73.8)	251 (67.3)	0.0089
CERVICAL CANCER				
Cervical cancer screening is an essential part of women's healthcare	190 (100.0)	190 (96.0)	380 (97.9)	0.0051
Cervical cancer is a very serious disease	191 (100.0)	188 (97.4)	379 (98.7)	0.0252
A cervical cancer screening program should be started or expanded in my community	188 (99.5)	186 (97.4)	374 (98.4)	n.s.
My patients have more pressing health problems than screening	189 (97.4)	165 (88.2)	354 (92.9)	0.0005
I have not had the necessary training in order to screen	136 (69.7)	158 (81.4)	294 (75.6)	0.0072

The screening tests are too expensive for my patients	115 (59.9)	143 (77.3)	258 (68.4)	0.0003
I do not have time or am too busy to screen	78 (41.5)	86 (46.5)	164 (44.0)	n.s.
I do not have the necessary equipment or supplies to screen	172 (87.8)	158 (84.0)	330 (85.9)	n.s.
The screening procedures are too difficult	84 (43.8)	108 (61.4)	192 (52.2)	0.0007
I do not have the necessary laboratory resources to screen	174 (90.2)	148 (80.4)	322 (85.4)	0.0075
I do not have the capacity to follow-up with patients after screening	103 (54.8)	126 (67.7)	229 (61.2)	0.0101

* Values are frequency (percent). "I don't know" responses coded as missing.

† P-value is for χ^2 test between Healthcare Professionals and Healthcare Students.

Table 4 Practices concerning breast and cervical cancer diagnosis and treatment[‡]

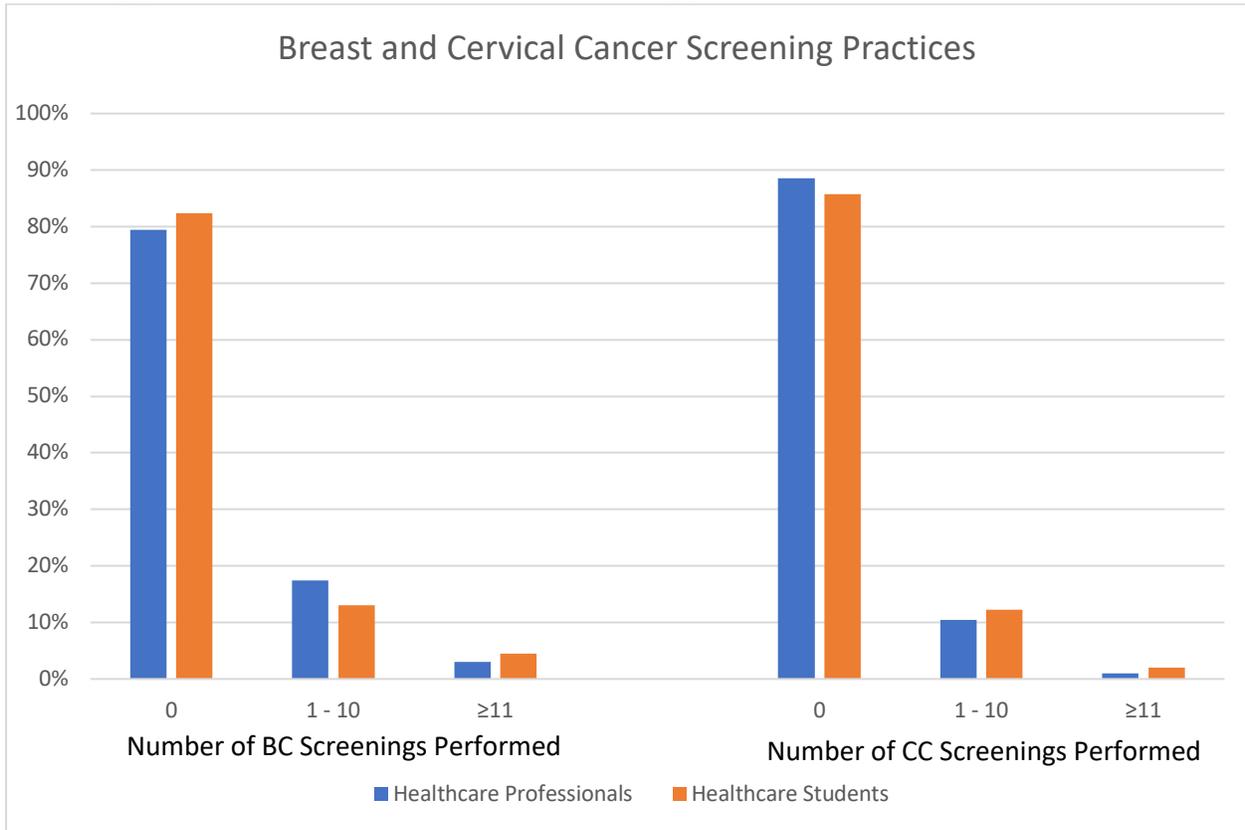
Question	Healthcare Professionals	Healthcare Students	Total	P-value [†]
	Yes*			
BREAST CANCER				
Have you ever diagnosed a patient with pre-cancerous breast lesions?	13 (11.2)	20 (12.7)	33 (12.0)	n.s.
Have you ever treated a patient with pre-cancerous breast lesions?	9 (7.8)	14 (9.2)	23 (8.6)	n.s.
Have you ever diagnosed a patient with breast cancer?	16 (13.8)	21 (13.7)	37 (13.8)	n.s.
Have you ever treated a patient with breast cancer?	17 (14.5)	16 (10.8)	33 (12.4)	n.s.
CERVICAL CANCER				
Have you ever diagnosed a patient with pre-cancerous cervical lesions?	29 (14.7)	37 (18.3)	66 (16.5)	n.s.
Have you ever treated a patient with pre-cancerous cervical lesions?	29 (14.7)	32 (16.2)	61 (15.5)	n.s.
Have you ever diagnosed a patient with cervical cancer?	43 (21.9)	33 (16.8)	76 (19.4)	n.s.
Have you ever treated a patient with cervical cancer?	42 (21.5)	28 (14.5)	70 (18.0)	n.s.

* Values are frequency (percent). "I don't know" responses were coded as missing.

[†] P-value is for χ^2 test between Healthcare Professionals and Healthcare Students.

[‡] A healthcare professional's supervisory presence is required for Somali healthcare students to conduct screenings or offer recommendations. Students exclusively assist professionals as part of a cancer patient's treatment team.

Figure 1 Proportion of medical doctors, nurses, and midwives having performed breast cancer screening procedures and cervical cancer screening procedures*



* Cervical cancer screening procedures included pap smear, HPV DNA testing, liquid-based cytology, visual inspection with acetic acid, and visual inspection with Lugol's solution

Table 5 Attitudes and Practices towards Breast Self-Examination[‡]

Question	Healthcare Professionals	Healthcare Students	Total	P-value [†]
	Strongly/Somewhat Agree*			
Have you heard of breast self-examinations? (Yes [§])	164 (85.0)	152 (78.8)	316 (81.9)	n.s.
Breast self-examination is a useful tool for the early detection of breast cancer	183 (97.3)	183 (94.3)	366 (95.8)	n.s.
Breast self-examination is difficult and time consuming	43 (24.4)	70 (38.0)	113 (31.4)	0.0054
I am confident that I could detect abnormalities in a breast if there were any	178 (97.3)	158 (87.3)	336 (92.3)	0.0004
I am confident I could teach someone to conduct their own breast self-examination	150 (81.1)	160 (83.3)	310 (82.2)	n.s.
I frequently recommend that patient conduct their own breast self-examination	142 (82.6)	139 (75.1)	281 (78.7)	n.s.

* Values are frequency (percent). "I don't know" responses were coded as missing.

† P-value is for χ^2 test between Healthcare Professionals and Healthcare Students.

‡ A healthcare professional's supervisory presence is required for Somali healthcare students to conduct screenings, provide treatment, or offer recommendations.

§ Answers shown in table for Question 1 correspond to the response: "Yes"