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Initiating a National Mammography Screening Program: The Kuwait Experience Training with a US Cancer Center

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Abstract

Purpose: To train Kuwait radiologists and technologists in breast imaging to create a Kuwait national mammography screening program (KNMSP) that provides high quality safe mammography services meeting international standards for early detection of small invasive breast cancers in asymptomatic women.

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Materials and Methods: 5 radiologists, 6 technologists and 1 physicist/radiation protection technologist from Kuwait trained at *x hospital* over a 3 year period utilizing Society of Breast Imaging/American College of Radiology guidelines and Food and Drug Administration Mammography Quality Standards Act requirements for education program content. On site visits in Kuwait were provided by *x hospital* radiologists and technologists 3 times during the program. The KNMSP was implemented to provide asymptomatic women ages 40–69 screening mammography services. A lead Kuwaiti breast radiologist collected and analyzed mammography results and outcome data utilizing descriptive statistics.

Results: 6933/164000 (4.2%) Kuwaiti women were screened with 83 cancers detected, 74 invasive and 9 ductal carcinoma in situ. Screening mammography sensitivity was 97.6%, specificity 88.2%, and PPV³ 37.1%. Diagnosis was stage 0 in 9/83 (10.8%), Stage 1 in 24/83 (28.9%), Stage 2 in 34/83 (41%), Stage 3 in 11/83 (13.3%) and Stage 4 in 5/83 (6.0%). 80% of women with breast cancer were diagnosed with tissue biopsy within 4 weeks of their screening mammogram.

Conclusion: The KNMSP demonstrates the successful training of Kuwait radiologists and mammography technologists with implementation of a national screening mammography program in Kuwait with acceptable sensitivity and specificity and timely diagnosis of early stage breast cancers.

Introduction:

In Kuwait, population 3,806,643, breast cancer is the most common female malignancy accounting for 39.8% of female cancers in 2012 [1–5]. Kuwait cancer registry data indicates the breast cancer age standardized incidence rate has increased 4 fold since 1974, likely attributable to changing lifestyle such as dietary changes, decreased physical activity and increasing obesity [5, 6].

Breast cancer early detection is vital and screening mammography decreases breast cancer mortality [7–12]. An organized population wide screening program requires health infrastructure/resources to provide long-term screening and diagnostic/treatment services. Well-trained radiologists and technologists are essential. Kuwait has financial resources to implement such a program meeting key World Health Organization criteria for program success [3, 13].

Kuwait Cancer Registry data confirms treatment availability with 77% of breast cancer patients having surgery, 66% chemotherapy, 47% radiation therapy and 39% hormonal treatment [5].

The Kuwait National Mammography Screening Program (KNMSP) was launched in 2014 in the 5 governorates of Kuwait. Previously breast cancer screening was purely opportunistic, mammograms performed at patient or physician request. KNMSP goals include cancer screening closer to the point of care, timely diagnosis, and strategic planning with a focus on infrastructure building and information management. An agreement between *x hospital* and the Kuwait Ministry of Health provided KNMSP support and created a breast cancer screening training program. The training program took place in the US and Kuwait and was

developed by *x hospital* radiologists/technologists, with a history of international education with previous experience training breast imagers from around the world including Croatia, Serbia, China and European radiologists through the European Society of Radiology

The KNMSP aims to provide high quality mammography meeting international standards for early detection of asymptomatic invasive breast cancer resulting in mortality reduction. Prior to this, Kuwait had only 1 certified breast imager and no breast imaging fellowships. Therefore, beyond training Kuwaiti radiologists/technologists, promoting breast imaging as a recognized subspecialty in Kuwait was also a program goal.

This is a report of the training program and KNMSP data from April 1, 2014 through March 31, 2016. Data is based on KNMSP centers only and do not reflect all screening as opportunistic screening still occurred at non-KNMSP facilities.

Materials and Methods:

Training Program

The educational training program included 5 radiologists, 6 technologists and 1 physicist/radiation protection technologist from Kuwait training at *x hospital* over a 3-year period. Prior to initiation, a legal contractual collaborative agreement between *x hospital* and the Kuwait Ministry of Health outlined program specifics and took several years to formulate. The program included training in the US and Kuwait with follow up to assess image quality, screening program results and a Continuing Medical Education (CME) course in Kuwait for Middle East radiologists/technologists. Although mammography interpretation was the focus, training in breast ultrasound, MRI, and breast biopsy performance was also essential with the goal to have those trained become breast imaging leaders in Kuwait and train others.

The Society of Breast Imaging (SBI)/American College of Radiology guidelines for breast imaging education and Food and Drug Administration (FDA) Mammography Quality Standards Act (MQSA) requirements formed the educational objectives and training program content [14–15]. Participating Kuwaiti radiologists had completed radiology residency and needed fellowship level training. A lead Kuwaiti radiologist was designated. It was deemed essential that training not be done in absentia. Due to hospital restrictions, Kuwaiti radiologists and technologists could only observe while in the US. In Kuwait instruction was hands on.

The US institution required computer based modules reviewing Health Insurance Portability and Accountability Act (HIPAA) compliance be completed by any individual with patient contact. HIPAA trained Kuwaiti radiologists participated in a 6-month breast imaging training program in the United States, the minimum SBI recommended fellowship length. The curriculum included how to utilize and interpret mammography, breast sonography, and breast MRI. Procedure skills including image-guided biopsy and wire/seed localization were taught. Quality control (QC)/quality assurance (QA) methods as outlined by MQSA and research methods training were also included. Kuwaiti radiologists interpreted images with

an *x hospital* attending radiologist, reviewed extensive teaching files and attended educational conferences.

Technologists are integral to the program and also needed a quality training program. Six technologists underwent three months of training at *x hospital* in patient positioning, QA/QC, and image-guided biopsies. MQSA and the American Society of Radiologic Technologists (ASRT) guidelines formed training program content [15, 16]. No prior knowledge was assumed, though most had some mammography experience. Technologists observed ~600 cases over 3 months, including diagnostic and screening mammograms, biopsies, and localizations, attended educational conferences and reviewed teaching files. Ultrasound and MRI were not part of their curriculum. Technologist training included reviewing screening recalls with *x hospital* radiologist and discussing cases needing repeat imaging, emphasizing a team based approach. As no physicist was available in Kuwait, 1 technologist was designated the radiation safety official to maintain equipment quality and safety and received additional QA/QC training from a US physicist. At the completion of training participants were provided a certificate documenting training.

50 Kuwaiti mammograms were initially reviewed to assess quality improvement needed. Another 50 mammograms were reviewed after technologist training to assess improvement and enable program quality monitoring by US experts. Mammogram reviews enabled identification of deficiencies and an opportunity to praise excellent work. The program contract also specified *x hospital* experts would review up to 200 mammograms for which Kuwaiti radiologists had questions.

On site Kuwait visits were provided by US radiologists and technologists 3 times during the program to evaluate image quality, image interpretation and biopsy performance. This enabled direct real time observation of patient positioning, biopsy technique and hands on teaching. QA assessment included evaluation of individual radiologist and overall program callback rates, positive predictive values, and breast cancer stage at diagnosis. QC included equipment testing and radiation dose assessment to optimize patient safety and equipment function. Following visits, a report with improvement recommendations was provided with follow up on subsequent visits. The final Kuwait visit culminated in a CME course for Middle East radiologists/technologists. The technologists' course also incorporated training in hands on patient positioning.

Screening Program

The KNMSP was implemented as a nation-wide breast cancer screening program in Kuwait providing annual screening mammograms for women 40–69 years old. The program provides results and additional diagnostic imaging and biopsy if needed. All digital mammography equipment was utilized. Breast MRI is available in all government hospitals, each with 2–3 scanners.

KNMSP services are delivered at 5 polyclinics, one in each of Kuwait's 5 medical health regions (Al-Asimah, Hawally, Al-Farwania, Al-Jahra and Al-Ahmadi) with 2 mammogram units each. The clinics, staff and equipment are regularly monitored by the main center in Al-Sabah medical health region to ensure high quality mammography. Women make an

appointment by calling one central number at which time it's ensured she is at least 40 years old, asymptomatic, has no breast cancer history and no mammogram in the last year. Program awareness was provided through a large multi-media advertising campaign.

A trained technologist conducts the mammogram and completes an electronic questionnaire available to the radiologist. There is a network Picture Archiving and Communication System (PACS) between the polyclinic breast imaging centers and main reading center in Al-Sabah. Two radiologists, with 5–6 years breast imaging experience, independently read the study and record results. Conflicting interpretations are resolved by radiologist discussion or a 3rd reader. The KNMSP center archives patient information and provides immediate access to prior images/reports providing efficient filmless/paperless mammography screening.

With Kuwait Ministry of Health approval, the lead Kuwaiti breast radiologist collected and analyzed mammography results and outcome data utilizing descriptive statistics.

Results:

164,000 Kuwaiti women were between 40–69 years of age and eligible for screening from April 1, 2014 through March 31, 2016. 6933/164,000 (4.2%) women were screened at KNSMP centers and 83 cancers detected (Figures 1 & 2).

KNMSP is notified by outside facilities if a missed or interval cancer is found. One missed cancer and one interval cancer was reported. 1424/6933 (20.5%) cases required 3rd reader involvement or radiologist discussion to reach consensus on discrepant screening interpretations. Positive predictive values (PPV), sensitivity and specificity were calculated (Table 1).

80% of women with breast cancer were diagnosed by biopsy within 4 weeks of their abnormal screening mammogram with disease stage recorded (Table 2). All women recommended for additional imaging and/or biopsy had them performed.

Discussion:

The KNMSP demonstrates the successful implementation of national mammography screening, with acceptable sensitivity and specificity as defined by MQSA and timely diagnosis of early stage breast cancers, in conjunction with a collaborative training program. Kuwait's small population facilitates service centralization providing infrastructure to ensure women receive additional imaging/biopsy if needed. Notably, no patients were lost to follow up in this two-year period and timely diagnosis was observed, with 80% of patients receiving a diagnosis within 4 weeks of initial screening, meeting a program goal.

Mammography performance benchmarks amongst US radiologists include a recall rate of 9.8%, PPV₁ of 4.8% and PPV₃ of 33.8% [17]. The KNMSP recall rate was higher, 14.7%, with higher PPV values, PPV₁ of 8.2% and PPV₃ of 37.1%. 10.7 invasive cancers were found per 1,000, higher than the US screen cancer detection rate of 4.6 per 1,000 [14]. KNMSP data likely represent mixed incidence and prevalence screening; given prior

mammogram history was not known. Analysis of cancer detection rates with continued program screening will be essential. There is no screening mammography data available prior to the training and KNMSP for comparison.

Diagnosis of early stage tumors when treatment is more effective is essential. Compared to the Kuwait Cancer Registry data prior to the KNMSP, earlier stage of diagnosis was noted with institution of the KNMSP [5] (Table 2). Exact comparisons are limited as registry data includes symptomatic women and reported 29% as unknown cancer stage. KNMSP, a new program with only 5 facilities, screened only 4.2% of the eligible population. Additional women received opportunistic screening, however, that data is unavailable.

The training partnership between *x hospital* and the Kuwait Ministry of Health likely contributed KNMSP success. This partnership demonstrates the time investment required, several years, to reach a collaborative agreement and provide meaningful training. Logistics of visas, travel arrangements and hosting international guests involve multi-level departmental/institutional support and is a labor intensive process. The training program adds cost and time considerations for the screening program including trainee living expenses in *x city* for 3–6 months, travel costs and CME course support.

Limitations included the inability of Kuwaiti technologists/radiologists to actually perform imaging and procedures in the US. This was partially overcome through extensive observation, phantom use and direct real time observation by *x hospital* staff in Kuwait as hands on training is essential. The inability to identify a Kuwait physicist is not an uncommon problem abroad and led to a technologist training in those skills, a limitation given the technologist's background knowledge is not that of a physicist [18]. Potential obstacles in this kind of program include cultural and language difficulties. Our collaboration was made easier by lack of language barriers. Translation of the Breast Imaging- Reporting and Data System (BI-RADS) atlas to Arabic was discussed but deemed unnecessary due to physician English proficiency but should be a consideration in such partnerships [19]. There was initial concern patients may not allow foreign physicians and technologists in examining rooms; however, this problem was not encountered. All radiologists and technologists visiting Kuwait from the US were female except for one male radiologist. Regarding data and privacy, attention was given to HIPAA and hospital trainings, as cultural differences may exist. Finally, this program highlighted the importance in training others one must acknowledge both sides are professionals working together in a partnership.

Future directions for Kuwait breast imaging, training and continuing education are numerous. To continue high-quality breast imaging in Kuwait, it is essential to incorporate formal breast imaging training into residency, include breast imaging on board examinations, establish a breast imaging society and create minimum mammography reading requirements. These efforts are underway. Technologists are investigating forming a local society offering ASRT type credits available for Kuwaiti technologists. The CME program in Kuwait was part of an effort to establish those radiologists trained through the program as local authorities enabling them to train those in Kuwait and the Persian Gulf region to improve quality regionally.

Future directions for the KNMSP include increased breast cancer awareness campaigns to reach more women, aiming to screen 70% of the population. Training more radiologists/technologists and increasing imaging capacity is necessary to provide quality screening to this extent. Long term follow up will determine the KNMSP affect on breast cancer mortality.

Conclusions:

The KNMSP demonstrates the successful training of Kuwaiti radiologists and technologists with implementation of a national screening mammography program in Kuwait with acceptable sensitivity and specificity and timely diagnosis of early stage breast cancers. Future examination of long term mortality affects will be essential. Training programs must be further developed within Kuwait to build upon knowledge gained and to affirm breast imaging as an important radiologic subspecialty.

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Figure 1. Kuwait National Mammography Screening Program (KNMSP) summary of results, April 1, 2014 through March 31, 2016.

Figure 2.
Cancers detected by the KNMSP, April 1, 2014 through March 31, 2016.

Table 1.

Positive Predictive Values (PPV), sensitivity and specificity of screening mammography in the KNMSP.

PPV ₁	83/1017 (8.2%)
PPV ³	83/224 (37.1%)
Sensitivity of screening mammography	97.6%
Specificity of screening mammography	88.2%

Table 2.

Stage at diagnosis of 83 women diagnosed with breast cancer via KNMSP screening compared with available 2012 Kuwait Cancer Registry data prior to the KNMSP (note 29% of cancer registry patients had an unknown stage) [5]. Nodal status of 74 women diagnosed with invasive breast cancer.

Stage at Diagnosis	KNMSP	Stage 2012 Kuwait Cancer Registry*	Nodal Status	
Stage 0	9/83 (10.8%)		No nodal metastasis	45/74 (60.8%)
Stage 1	24/83 (28.9%)	10%	N1	21/74 (28.4%)
Stage 2	34/83 (41%)	31%	N2	7/74 (9.5%)
Stage 3	11/83 (13.3%)	23%	N3	1/74 (1.3%)
Stage 4	5/83 (6.0%)	7%		