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Centralization of mammography reporting with mobile trucks: Turkish experience

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ABSTRACT

Screening via mammography is a complex process to be implemented. Objective: To report the initial results and the effectiveness of newly implemented Turkey's population based breast cancer screening program performed for 40–69 years old women; and effectiveness of the newly implemented out-sourcing mobile trucks and national central report center. The study is conducted prospectively in one year (March 2016–March 2017) in all 81 provinces of Turkey. Mammography images were transferred via on-line web based system to the central reporting center. BI-RADS Scores and KETEM models (Mobile vs. Stationary) were the parameters were compared. In total mammography images of 414.802 patients were transferred from 155 KETEMs to the central reporting center. From these patients; 95.872 (23,1%) were aged between 40 and 44. Among all images, 21.999 (5,3%) were BI-RADS 0-4-5, 391.123 (94,3%) were BI-RADS 1–2. Totally recall rate of the national reporting center was 5.3%. Number of patients screened per day were significantly higher in out-sourcing mobile trucks compared to stationary KETEMs (31.8 vs. 8.9; $p < 0.05$). This is the first and the largest breast cancer screening study which results of a population based mammography screening for 40–69 years old women are evaluated at the same time with the evaluation of the efficacy of newly implemented centralized reporting center and the mobile screening trucks in comparison with stationary cancer screening centers. According to the initial results; Turkey's newly implemented population based breast cancer screening system seems to be feasible and effective.

1. Introduction

Breast cancer is the most common cancer diagnosed in females through worldwide and mammography is the golden standard technique used for screening breast cancer (Lauby-Secretan et al., 2015). None the less screening via mammography is a complex process to be implemented. It needs to provide standardized screening units, mammography devices, meanwhile maintaining their technological infrastructure and supplying timely technical services for technique malfunctions. Besides, this system needs well trained/experienced as well as dedicated radiology technicians (mammographers) and radiologists. Based on these realities, even in European Union (EU), there are still limited number of countries which achieved to have > 70% coverage rates in breast cancer screening (https://ec.europa.eu/health/sites/health/files/major_chronic_diseases/docs/2017_cancerscreening_2ndreportimplementation_en.pdf, n.d.). In spite of these, development of technology in different eras within the last decades gave us the opportunity to use these innovations in implementing more efficient screening systems in which national reporting centres and mobile screening trucks play an active role.

In Turkey, breast cancer screening program has started in early 2004 within the specialized cancer screening centers (Cancer Early Diagnosis, Screening and Education Centers-KETEMs). In addition to the mentioned difficulties above, Turkey's cancer control program for the years 2009–2015 underlines further difficulties such as having a large surface area, difficulties met through the transportation of the patients, having a crowded target-population and limited men-power. Due to these reasons, our breast cancer screening coverage rates could never be able to exceed 25%. In addition to this, our recall rates were also so high and were over 70% with a median rate of 25 days for one mammography's report/result (http://www.thewhpca.org/resources/item/national-cancer-programme, n.d.).

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Another big debate in Turkey's breast cancer screening system was the starting age for the mammography screening. Up-to-date evidence shows that sensitivity of mammography for ages 40–49 is low and is not recommended by some EU countries and many other societies (https://ec.europa.eu/health/sites/health/files/major_chronic_diseases/docs/2017_cancerscreening_2ndreportimplementation_en.pdf, n.d.; Committee on Practice Bulletins—Gynecology, 2017; Siu and on behalf of U.S. Preventive Services Task Force, 2016; American Cancer Society website, 2016), in spite of this scientific fact, national cancer statistics shows that half of the breast cancers diagnosed in Turkey were below 50 years old (http://kanser.gov.tr/Dosya/ca_istatistik/2014-RAPOR._uzun.pdf, n.d.). Within all these difficulties and debates, Turkish Ministry of Health has organized a serial national and international workshop with the attendance of the experts in all around the world. And in the end of these workshops and national/international advisory board consultations, the Ministry of Health has decided to extend breast cancer screening age to 40 years for the next three screening rounds, and updated the national breast cancer screening guidelines accordingly. According to this updated guideline, nationwide population based breast cancer screening program invites all females aged 40–69 biannually (http://kanser.gov.tr/Dosya/tarama/meme.pdf, n.d.; http://kanser.gov.tr/Dosya/Kitaplar/Turkiye_Kanser_Kontrol_Programi_ng.pdf, n.d.). In addition to this major alteration in the guide-line, Ministry of Health also made some infrastructural changes in the screening system such as adding ten out-sourcing mobile trucks (Mobile KETEMs) to the existing stationary KETEMs in order to increase the coverage rates and implementing a national mammography reporting center for the evaluation of all screening mammography images in order to overcome the limited men-power and raise the quality of the breast cancer screening service.

After these innovations, Ministry of Health has started a prospective pilot study by March 1, 2016 for the next three years. The new system included; renewed local call and recall strategy with a centralized and fully automatized monitorization of individual screening status, well defined national algorithms, a single nationwide centralized mammography reporting center which had just 4 full time radiologists. This is the first and the largest breast cancer screening study which results of a population based mammography screening for 40–69 years old women are evaluated at the same time with the evaluation of the efficacy of newly implemented centralized reporting center and the mobile screening trucks in comparison with stationary cancer screening centers.

2. Material and method

2.1. National screening guidelines and screening flow

According to the recently published guideline; Turkey's nationwide breast cancer screening program's target population includes all women who are 40–69 years old. This target population is invited via a call & recall system and these invitations are done by primary level health stuff (family physicians and population based screening centers-KETEM's stuff). Women aged between 40 and 69 years are invited for breast cancer screening by primary level health staff (family physicians and so called KETEM screening centers) every two years. All screening processes are free of charge for the eligible individuals. Before further examination, all applicants are asked for being asymptomatic, and having a history of previously known mass in breast or not. The symptomatic ones and the ones with the history of previous mass in breast are consulted to the secondary health care system and are excluded from the screening program. Before breast cancer screening, patients are checked for a recently taken mammography by using web-based database of ministry of health and screening is not allowed for patients who had taken a mammography within the last 18 months. Clinical breast examination is optional for the family physicians and therefore it is not included in this analysis. The screening is done in both mediolateral oblique and cranio-caudal positions per each breast. All radiological images are transferred to national mammography report center via web-based on-line system and evaluated in a double blind manner by at least two radiologists. Mammography images are reported according to the American College of Radiology (ACR) BI-RADS criteria and also breast patterns are classified according to ACR criteria. All patients with a BI-RADS Score 0, 4 and 5 are referred to specialized breast cancer detection and treatment centers for further evaluations.

Approximately 24,000 family physicians and a similar number of nurses work across the whole country. Each family physician and nurse has about 3500 people to serve, among which 700–800 are > 40 years old women and have to be screened in two years (this means 350–400 women are in target population for breast cancer screening for each year for each family physician). Family physicians do approach women via e-mail/telephone/letter or face to face invitations. In case of no response, a second invitation is sent annually.

2.2. Screening centers, national mammography report center

Cancer early diagnosis, screening and education centers (KETEMs) were implemented across the whole country since 2004. One KETEM was planned to serve for 250,000 people. KETEMs serve for the women who live in not so far-where it takes maximally 90 min by public transport. KETEMs are responsible for population based screening for breast, cervical and colorectal cancers with different age intervals. By year 2012, at least one KETEM was existing in each province of the country, and had conventional mammography systems. KETEMs which were implemented after 2012 have digital systems. Totally there are 145 KETEMs all around the country which means in 81 provinces. Of these, 111 (76,5%) have full field digital mammography (FFDM) while remaining 34 (23,5%) have conventional systems with computerized radiography (CR).

Additionally, 10 mobile trucks (mobile KETEMs and called as “Pink Princesses” by the “public”) were implemented by early 2016 with outsourcing model and have started to work by 1 March 2016. Each truck also has a full field digital mammography (FFDM), fast intra-truck internet and 3 radiology technicians (mammographer). These trucks work in 8 provinces (Malatya, Sivas, Bursa, Trabzon, Adana, Konya, Usak and 3 in Istanbul). Working hours were similar to stationary governmental KETEMs. Mobile truck and stationary units was same capacity. People selected randomly in mobile or stationary units.

All mammographic images are transferred to a national report center in Ankara, using web-based on-line system. Each radiologist is specially trained for screening mammography by Turkish Society of Radiology and have special evaluation opportunity with 5 MP diagnostic workstation. Evaluation and study works are in accordance with EU guidelines and each radiologist evaluates maximally 200 patients' breast images with 2 hours' rest time in between. A total of 3 radiologists are working in the center for full time and 29 are working as partial time.

Mammography center capacity is 10,000 patient results per week and can be upgraded accordingly depending on the number of the breast cancer screenings per week, using trained part time radiology experts (All the process from the mobile trucks to the national report center can be viewed from “https://www.youtube.com/watch?v=KQPlvdSEJHg”).

A newly generated special software program is used to monitorize each step of the centers and mobile trucks and this program is called as RUNLEK MMScreen Module (www.runlek.com). RUNLEK program shows each step of the analysis, starting from the internet transfer of the images to the reporting stage. In case of a problem in either of the steps, a warning message is sent to the ministerial authorities and the directors of the center in order to solve it quickly and this allows all patients results to be reported in 10 days. RUNLEK also enables the health authorities to monitorize the system by on-line statistical analysis of the BI-RADS scores, screening rates, daily patient numbers, and the names of the responsible radiologists for the reports, per each city, per a given

Table 1
Comparison of performance of stationary vs. out-sourcing mobile KETEMs[c].

		Stationary KETEM	Out-sourcing mobile KETEM	Total	p[a]
	Total numbers	145	10	155	
	Total working days	252	234	–	
	Number of patients screened per day	8.9 ± 7.03	31.8 ± 10.45	–	0.000[b]
Mammography device	Conventional + CR	34	0	34	
	Digital	111	10	121	
Number of screened patients	Conventional + CR	43,043 (13.2%)	0 (0.0%)	43,043	
	Digital	282,215 (86.8)	89,544 (100.0%)	371,759	
Age	40–44	74,989 (23.1%)	20,883 (23.3%)	95,872	
	45–49	66,533 (20.5%)	18,318 (20.5%)	84,851	0.104
	50–59	124,106 (38.2%)	33,795 (37.7%)	157,901	
	60–69	59,630 (18.3%)	16,548 (18.5%)	76,178	
BI-RADS score	Insufficient	1175 (0.4%)	505 (0.6%)	1680	
	Conventional + CR	414	0	414	
	Digital	761	505	1266	
	0-4-5	17,062 (5.2%)	4937 (5.5%)	21,999	0.000
	1–2	307,021 (94.4%)	84,102 (93.9%)	391,123	
Breast pattern	A	50,067 (15.5%)	9553 (10.7%)	59,62	
	B	149,106 (46.0%)	45,734 (51.4%)	194,84	
	C	110,004 (34.0%)	30,428 (34.2%)	140,432	0.000
	D	14,906 (4.5%)	3324 (3.7%)	18,23	

[a] Pearson chi square test.
[b] Mann-Whitney U test.
[c] KETEM: Cancer early diagnosis, screening and education centers.

time period, for each KETEM or for the whole country (See the video link above).

Patient results are sent to each family physician and KETEM personnel through internet once they are reported in the national center. Medical stuff can reach the results only by using their private passwords. Results include BI-RADS Scores, breast pattern (A, B, C, D) and a schematic picture of the two breasts showing the lesion localization; for each case. Additionally, a patient friendly web portal (https://mmtarama.saglik.gov.tr/randevu/mamografi-sonuc-sorgula) is prepared for the patients and they can directly reach their results by using this portal and just with registering their barcoded unique numbers and their personal citizen numbers. All images are stored digitally for three years. For the cases who have "positive" results (BI-RADS 0,4,5), a CD or pressed hard copies of the images are sent to their family physicians.

2.3. Data collection, study design and statistical methodology

Data for primary breast cancer screening performed and the results are prospectively monitorized and collected via MM-Screen Module Program without any missing value. The study was conducted prospectively for one year (March 2016–March 2017) in all 81 provinces of Turkey. Women aged 40–69 years old were invited for breast cancer screening to specialized population based screening units (stationary or mobile KETEMs). Age of patients (mean and age intervals of 40–44, 45–49, 50–59, 60–69), daily number of screened patients, BI-RADS scores of mammography reports, number of active working day, age and type of the mammography device (conventional vs. digital) and the province of the screening units were the parameters collected for analysis. As a candidate country of the European Union, Turkey is included in the Nomenclature of Territorial Units for Statistics (NUTS). Twelve (n = 12) NUTS-1 Regions of Turkey were used with similar socio-economic and geographic baselines (Istanbul, West Marmara, Aegen, East Marmara, West Anatolia, Mediterranean, Central Anatolia, West Blacksea, East Blacksea, Northeast Anatolia, Central East Anatolia and Southeast Anatolia Regions) for comparison of provinces. All parameters were descriptively compared according to KETEM service models (stationary vs. out-sourcing mobile trucks) and according to BI-RADS scores (BI-RADS 0,4,5 vs. BI-RADS 1–2).

Data record and statistical analyses were performed using Statistical Package for Social Sciences (SPSS) for Windows 20 (IBM SPSS Inc., Chicago, IL). The categorical variables were expressed as number and percentage and analyzed using Pearson's chi-square test. The Mann-Whitney U test was used to analyze the difference between the stationary KETEM and out-sourcing mobile Trucks for number of patients screened per day.

3. Results

3.1. Baseline parameters for Turkish population based breast cancer screening before the project

By January 2016-before the project started-baseline ministerial screening parameters were very poor for basic quality indices. Double-blind reading was possible only in < 50% of the mammography evaluations. Median time to report for a patient mammography result was > 20 days. Overall recall rate was also > 70%.

3.2. Evaluation of national mammography report center

Totally, images of 414.802 patients which were transferred from 155 KETEMs in 81 provinces, evaluated in this analysis. Each patient had at least 2 view images per each breast and reported in a double blind manner. Of these patients; 95.872 (23,1%) were aged between 40 and 44; while 84.851 (20,5%) were 45–49, 157.901 (38,1%) were 50–59 and remaining 76.178 (18,3%) were between 60 and 69 years of age (Table 1).

The reporting center worked actively in all days of the year and all results were reported in < 10 days. The mean number of reporting for was around 2000 patients per day and maximally 400 images per each full time radiologist. Among all images, 21.999 (5,3%) were BI-RADS 0-4-5, 391.123 (94,3%) were BI-RADS 1–2 while remaining 1680 (0.4%) had insufficient images for BI-RADS scoring. Totally recall rate of the national center was 5.3% (Table 1).

Excluding the insufficient images, comparison of BI-RADS scores for remaining patients is presented in Table 2. BI-RADS scores did show a significant difference with respect to age, NUTS regions, KETEM type or mammography device and breast pattern. "A" pattern seen in BIRADS 1–2 group was 14.9% while it was 6.8% for BIRADS 0-4-5 group (p = 0.00) (Table 2).

Table 2
Comparison of patients with respect to BI-RADS scores.

		BI-RADS 0,4,5	BI-RADS 1–2	p[a]
Age	40–44	4822 (21.9%) (5.1%[b])	90,554 (23.2%)	0.000
	45–49	4655 (21.2%) (5.5%[b])	79,819 (20.4%)	
	50–59	8325 (37.8%) (5.3%[b])	149,008 (38.1%)	
	60–69	4197 (19.1%) (5.5%[b])	71,742 (18.3%)	
Geographical distribution	North Part (NUTS West and East Blacksea)	2982 (13.6%)	61,037 (15.6%)	0.000
	South Part (NUTS Mediterranean)	3199 (14.5%)	49,444 (12.6%)	
	West Part (NUTS Aegean, West Marmara, East Marmara, İstanbul, West Anatolia)	11,729 (53.3%)	206,241 (52.7%)	
	East Part (NUTS Middle East, South East and North East anatolia)	2534 (11.5%)	45,911 (11.7%)	
	Central Part (NUTS Central Anatolia)	1555 (7.1%)	28,490 (7.3%)	
KETEM[c]	Stationary	17,062 (77.6%)	307,021 (78.5%)	0.001
	Mobile	4937 (22.4%)	84,102 (21.5%)	
Mammography device	Conventional + CR	1861 (8.5%) (4.4%[b])	40,768 (10.4%)	0.000
	Digital	20,138 (91.5%) (5.4%[b])	350,355 (89.6%)	
Breast pattern	A	1505 (6.8%)	58,115 (14.9%)	0.000
	B	10,521 (47.8%)	184,319 (47.1%)	
	C	8763 (39.8%)	131,669 (33.7%)	
	D	1210 (5.5%)	17,020 (4.4%)	

Breast Pattern A: Almost entirely fatty, B: Scattered areas of fibroglandular density, C: Heterogeneously dense, D: Extremely dense.
[a] Pearson chi square test.
[b] Recall rate.
[c] KETEM: Cancer early diagnosis, screening and education centers.

3.3. Evaluation of mobile trucks vs. stationary KETEMs

Comparison of stationary vs. mobile KETEMs did not reveal a significant difference with respect to patients' age. Nevertheless; through this comparison patients' breast patterns and patients' BI-RADS scores showed statistically significant difference ($p < 0.05$) (Table 1) However, daily number of screened patients were significantly higher in outsourcing mobile trucks compared to stationary KETEMs (31.8 ± 10.45 vs. 8.9 ± 7.03; $p < 0.05$) (Table 1). Mobile trucks have started to serve by date 01. March 2016.

4. Discussion

Breast cancer is the most common cancer diagnosed in women through worldwide, and also it is one of the main cancers which can be detected at early stage. Up-to-date scientific evidence still shows that “Mammography” is the golden standard method used for screening breast cancer (Lauby-Secretan et al., 2015). However, there are limited number of countries in the world with successfully implemented breast cancer programs with high coverage rates and quality assurance. This article aimed to summarize the recent revolutions in Turkish population based breast cancer screening program and to share this experience with respect to different results and debates.

One of the questions analyzed in this report was to evaluate the efficiency of out-sourced mobile trucks. Mobile trucks give the opportunity to screen females both in rural and urban areas with a service that comes to very close proximity of women. This study found daily number of screened women within working days to be 31.8 within mobile trucks compared to 8.9 in stationary. This number is among the highest for mobile trucks compared to the previously published reports. There are many reasons for females to prefer mobile services, such as screening localizations, convenience, feeling comfortable by avoiding social and geographic barriers (Yu-Mei and Hsueh-Hua, 2013; Brooks et al., 2013; Drake et al., 2015; Guillaume et al., 2017). And a great majority of the females screened also showed a tendency to continue on mobile trucks for future screening rounds. Another advantage of the mobile trucks reported within the published literature is the accessibility of screening service by minority or disadvantaged populations (Yu-Mei and Hsueh-Hua, 2013; Brooks et al., 2013; Drake et al., 2015; Guillaume et al., 2017). Lee and Yao determined that participants' preferences for the location of further mammography screenings were; 21.3% of the women surveyed preferred mobile mammography for screening while 7.6% favored a hospital setting. This study also questioned the reasons that determined the preferences of participants and indicated that convenience (53.4%, 265 of 502) and comfort feeling (21.4%) were important while participants were making their selections (Yu-Mei and Hsueh-Hua, 2013). Brooks et al., found that 29% of participants in the screening program with mobile mammography had never taken mammography before or had not taken mammography in the last 5 years. In addition, mobile trucks were priority preference of the participants for future screening mammograms (Brooks et al., 2013). Drake et al., demonstrated that mobile mammography is successful for participating in recurrent mammography > 50% of the disadvantaged population (Drake et al., 2015). Guillaume et al., compared participation rates in mobile centers vs. fixed centers and found higher participation rate (60.2% vs 42.2%) for mobile centers and concluded that social and geographic challenges for participation of screening may be decreased by implementing mobile mammography trucks (Guillaume et al., 2017). However, this is not the case in all over the world and there are also some contradictory reports (Maheswaran et al., 2006). Therefore, even if this model works especially for developing countries, each country should make its' own needs assessment and pilot studies to see the feasibility and effect of screening models within their local conditions (Maheswaran et al., 2006). Considering the number of per day screening; mobile trucks were more preferred and more effective in this study, at least four times more daily screening numbers than stationary screening systems were achieved. Our one-year experience showed us that; the visibility of the mobile trucks within the streets and easy access to service options and not having any hospital related procedures were the main reasons for increased participation. Stationary KETEMS were mainly located within the hospitals and this could make the people to be unwilling for joining the screening program. Even if the KETEMs were outside the hospitals, considering the center will exist there for many more years could make the women to delay their attendance to the screening program. This was not the case for mobile trucks. Knowing that the truck will move in 10 days and will not be there for 2 years also motivated females to participate for breast cancer screening.

Out-sourcing mobile trucks had 3 radiology technicians per truck and one driver for 3 trucks. All truck investments together with mammography infra-structure, repairs and truck staff were paid by a company and the government just paid a constant price per patient, similar to the price given by the social security institute. However, for stationary KETEMs, each had contained a mammography device, at least 2

radiology technicians and at least one secretariat. Each stationary KETEM have extra costs such as the rent of the building and the payments of the extra staff working at that building, and these all are paid by the government. Additionally, all mammography repairs plus necessary heating costs were paid by the government. The cost of a single patient screening paid after out-sourcing tender was the same with a mammography report cost in an opportunistic screening condition. Given all these costs and daily patient numbers, this report shows the superiority of out-sourced mobile KETEM model compared to stationary KETEMs.

Another evaluated issue was the efficiency of the central mammography reporting center. A Pubmed research with key-words tele-radiology/mammography report center/centralization of mammography reports revealed no previous publication related to a national center for evaluating the all mammography images of a country in a population based screening program. Therefore, this is the first study in the literature evaluating such center. Images were transferred from mobile and fixed KETEMs to the reporting center without any significant loss in quality. Pallamar et al., found uncompressed digital mammograms can be transmitted to different institutions with different workstations, without loss of information. Thus, evaluation of the transferred data does not significantly affect image quality, lesion detection, or BI-RADS rating (Fruehwald-Pallamar et al., 2013). However, internet and energy infra-structure of the country is for sure would be an important issue before implementation of such system. The center had reporting capacity of 1136 patients' mammography images per day, by just 4 full-time radiologists, in a double blind manner. With this system the radiologist needs of KETEMs disappeared and screening has continued smoothly all around the country, without an interruption due to limited men-power within certain provinces. Compared to basal breast cancer screening measures, with central reporting unit recall rate noticeably decreased to 5,3% which potentially decreased the patients' unnecessary costs resulting from the consultation period. Total report time of all cases was < 10 days and all cases were reviewed in a double blind manner. All radiologists who work at the reporting center were trained in screening mammography reporting and the usage of specific software (RUNLEK MMScreen Module for screening process follow up and quality control) system gave us the on-line monitorization opportunity by giving the analysis of BI-RADS scores given, the number of mammography images reported per day and personal performances of accuracy in inter-observer variabilities after double-blind reviews.

A final evaluated issue was the efficacy of the screening the women who are between ages 40–49. This is a current debate among breast cancer screening guidelines. There are some societies suggesting a screening program between this age interval, but also some others do reject a screening program (Lauby-Secretan et al., 2015; https://ec.europa.eu/health/sites/health/files/major_chronic_diseases/docs/2017_cancerscreening_2ndreportimplementation_en.pdf, n.d.; Committee on Practice Bulletins—Gynecology, 2017; Siu and on behalf of U.S. Preventive Services Task Force, 2016; American Cancer Society website, 2016). The main reason for objecting screening in this age interval is possible higher recall rates and false positive results in ages 40–49. With a central reporting unit, this study showed that the recall rates were similar with the other age intervals and therefore at least according to recall rates screening the 40–49 age interval seems to be feasible. On the other hand, for patient's perspectives, some studies showed that false positive results or recall don't produce excess hesitation for females to undergo a screening mammography (Yu-Mei and Hsueh-Hua, 2013; Schwartz et al., 2000). Lee and Yao showed that women preferred to continue to screening in despite of the false positive results (77.3%), and used invasive and non-invasive tests (83.9% and 81.9%, respectively) if early diagnosis was possible (Yu-Mei and Hsueh-Hua, 2013). Schwartz et al., found that women were aware of false positive results as an acceptable outcome of screening mammography (Schwartz et al., 2000). On the other hand, in some countries, breast cancer ratio is higher between 40 and 49 compared to > 50 years. In Turkey, about 55% of all breast cancers are diagnosed before ages 50 (http://kanser.gov.tr/Dosya/ca_istatistik/2014-RAPOR._uzun.pdf, n.d.). In the study of Pitman et al., 18.8% of 40's women had breast cancer detected by screening. More than 60% of them were invasive and if the starting age of screening 50 was used; 9–19% of screen-detected breast cancers wouldn't be recognized (Pitman et al., 2017). The initial results of this study with central reporting system are encouraging for similar developing countries with high ratios of breast cancer under ages 50. However, for a definite conclusion, the authors suggest to wait for the final pathology results of the screened people which will be collected within 2018 by ministry of health cancer registry units linked to screening units.

One of the objectives of this study was to compare efficiency of digital vs. conventional mammograms. Central mammography report unit also gave us the opportunity to make the comparisons in an unbiased manner for any possible reasons due to the radiology experts. In general, recall rate (BI-RADS 0-4-5) was similar between both arms (4,4% vs. 5.4%) with slightly higher rates seen in conventional devices. These results for sure could not be extrapolated without the final pathology end results, however still underlies non-inferiority with conventional mammography in short term results by recall rates.

This is the first prospective observational study in the literature which evaluates all the hot debates (screening and recall rates between ages 40–49, central reporting and mobile trucks) on breast cancer screening programs at the same time period. The results are prospectively collected from a real nation-wide screening program rather than a pilot project. It also include the largest number of patient numbers in the literature focusing on these debates. However, for the definite efficiency and cost effectiveness analysis, final pathology results of screened patients are needed and will be published by 2018. Nevertheless, till then health authorities of the other countries can make their own evaluations for implementing a central mammography reporting center with mobile trucks at least to increase the attendance rates to breast cancer screening programs.

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