



Centralization of mammography reporting with mobile trucks: Turkish experience

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ARTICLE INFO

Keywords:

Turkey
Breast cancer
Mammography
Screening
Young ages
Mobile
Stationary
KETEM

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_2n-dreportimplementation_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.thewhpc.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 staff (family physicians and population based screening centers-KETEM's staff). 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 out-sourcing 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

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